AMERICAN MACHINIST

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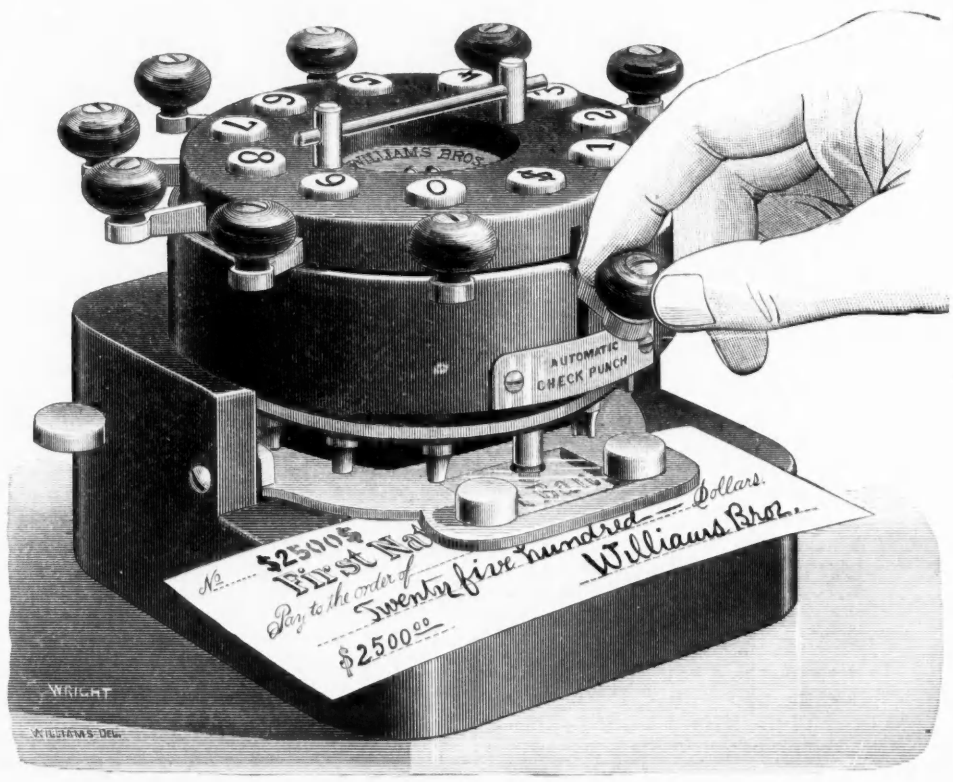
Williams Bros. Automatic Check Punch.

The Williams Brothers Automatic Check Punch, shown in perspective on this page, is a most ingenious invention, and the details of its mechanical construction have been worked out with great skill. Most of people understand that a great deal of swindling is done by raising bank checks above their original denomination. Numerous plans and devices have been tried to prevent this species of fraud, but hitherto the skiilful rogue has succeeded in manipulating the writing so as to defy all check protectors. The Williams Automatic Check Punch is a machine designed to cut the figures out of the paper of a check, and thereby defy ingenuity to change the original order. The machine is in a compact form, convenient for placing on an office desk. It is about six inches high, the upper or rotating part being a miniature turret resting upon a neat, square base. Around the inside walls of the turret are arranged a series of dies working vertically each having the impress of a figure or $ sign upon its point, and opposite to this point, through a dial plate, is cut a corresponding letter, into which the die fits. The figure or mark held by each punch is identified by an index plate on the top of the turret, so that the operator can see which mark he is making. The dies are operated by keys resembling those on a telegraph instrument. When a check or other paper is to be marked, it is placed on the base of the machine, where a cap holds it in position. Whatever figure the operator now desires to punch on the paper, he selects by the appropriate key, turns it round to the vertical slot in the front of the turret and punches it down. The act of punching moves the paper automatically along, the machine acting so that an equal space shall be left between each of the marks, thus frustrating any attempt at inserting figures between them.



AUTOMATIC CHECK PUNCH.

The cap on the machine table holds a glass plate on top, which enables the operator to see how to place the check so as to have the figures cut on any desired part of its face. The feeding device consists of friction rollers let into the base of the machine. They are operated by a bow-shaped lever that encircles the inside of the turret and fits into a groove slotted on the side of each punch. The machine is made for the proprietors at the Brady Manufacturing Company's Works, 259 Water Street, Brooklyn, N. Y.

An Eastern correspondent writes saying, that through reading our remarks in a recent issue on runaway locomotives and our suggestion that inventors should try to devise a good throttle catch, he came to the conclusion that he could get out something to fill the bill. He set to work and designed a safety appliance for which he has made the necessary application for a patent. Having shown his device to a prominent railroad master mechanic that gentleman was so favorably impressed with the invention that he offered to give it a practical trial, which will shortly be made.

Early Engineering Reminiscences.

BY AN OLD ENGINEER.

SECOND PAPER.

After a number of bolts of the same size had been turned, came the thread cutting, and this may be considered an advance or evolution from haphazard hand chasing and die cutting to the present engine lathe work, and even at this day will be looked at as an ingenious device. On the 3″ of the overhanging back mandrel was slid up against its collar what Mr. White called his "screw guide;" it was a template screw of the diameter and pitch of the screws he was about chasing, of about 4″ in length on its thread; the portion projecting beyond the 3″ overhanging mandrel was closed to a square hole in its center, into which the tit heretofore described on the end of the screw bolt would loosely fit. The carrying center of the back mandrel was a round steel rod about 8″ long, perfectly straight beyond its pointed end. This center rod fitted in the center of the back mandrel, and was driven forward and held to its work by a wedge-key through a slotted hole in the mandrel. When the bolt on which the screw was to be chased was put in the lathe, the back head was driven forward by the wooden keys so as to bring it and the template firmly together; the back center was then driven forward by the key through the mandrel. By this arrangement the guide template was made to revolve with the screw bolt.

The chasing tool—or, rather, tool carrier—was wrought iron, in form of a cross, with very short, broad arms—in fact, they did not project more than half an inch beyond the body. These arms were grooved to carry the cutting tool and guide. The end of this carrier next the work was much lighter than the body, and was shaped so as to pass under the bolt to be cut and press against it opposite to the cutting tool. Both guide and cutting tool were firmly clamped to the carrier, and pressed forward and held in position by set screws through longer arms than the tool-carrying cross. The handle of the carrier was wood, about five feet long, with a drop handle of some 18″ or two feet. When the chasing was to be done, a steel bar with a narrow edge for the carrier to slide on was substituted for the iron bar-rest used in turning; this was well lubricated. The guide tool was shaped to fit into the thread of the template, both guide and cutting tool being adjusted in its thread. This generally placed the guide and the cutting tool about 3″ apart. The cutting tool was what might be called a stubby hook tool. In the first adjustment, the guide was set just as deep into the thread of the template as experience had taught the first cut could be made. The operator rested the long handle of the carrier on his left shoulder, grasping it in his left hand, steadying it by the drop handle in his right. The first cut required considerable skill on the part of the operator; the following not so much, as less care was required to adjust the guide and cutting tool. When the depth of required thread was cut, the screw was finished by a toothed comb that smoothed the work and gave a slight taper to the thread; the final polishing was done between dead centers. The brass nuts on all the wrought iron screws were cast on them, the screws being heated and well coated with rosin and lamp black over an open charcoal fire.

In chasing the large cast iron screws, the template or screw guide was not carried by the square tit, as in the case of the wrought iron screw, but simply by a steel pin in coinciding holes in screw bolt and template. The cutting tool also differed, as both guide and cutting tool were carried by a deep collar that was slid in to the template, fitting both it and the screw bolt; this collar had an arm that held it from turning by the lathe rest on which it slid, the guide tool being on the collar next the poppet head, the cutting tool on the opposite or advance side, and, as in the above described hand-carrying, the cutting tool going in advance of the guide—in fact, a screw cutting die with a single cutting point. When this die had traveled to the end of its cut, the cutter and guide were withdrawn and the die or collar slid back by hand, the tools readjusted and again started.

I recollect on one occasion my grandfather asked Mr. White why he did not adopt this simple plan to cut his wrought iron screws. The reply was, because it has *no feeling;* that no two bolts of wrought iron were ever alike in texture. He then expatiated largely on the necessity and advantage of a piece of ham skin, the fat side next the screw, that he placed in the lower part of the bend of his tool carrier that clasped the back of the screw. By bearing down the long handle of the carrier, this ham skin was pressed up against the bottom of the screw being cut, and, as he expressed it, so increased the sensitiveness of the touch that with his eyes shut he could detect the slightest dulling of the cutter, or, should a corner break off of it that might interfere with the guide, he was notified of it before the eye could possibly have detected it: again, he claimed that considering he could take a heavier cut when he could feel his work, and the time lost in backing the tools, sliding the collar carrier and again readjusting the tools, that he had an advantage that nearly doubled the amount of chasing per day.

On a simple plan being suggested to him of reversing the lathe and automatically starting and stopping that would run the tool back rapidly ready for a fresh cut, his comments were very characteristic of the man, and, no doubt, many other hand workers opposed to innovations. He had listened very attentively, and after what appeared to be due consideration, he said: "Nathan, I have no doubt what thee proposes would act just as thee suggests; but when I hire a workman I hire his brains as well as his hands. They are naturally careless enough, and if thee would save their thinking and give part of it to the machine, it would only make them more heedless, and I would be the sufferer. If I were to spend money to adopt thy jim-cracks, I would still be obliged to have the man to watch them, to set the tools and keep them sharp and in order, and why not let him do the work? It is better for him than to stand with his hands in his pockets; they would soon be in mine."

The heavy cast iron nuts for the cotton press and paper mill screws were bored by head and cutters on a vertical boring bar, guided both above and below the nut, which was clamped on a wooden platform, the boring bar and head being worked capstan fashion by men walking around pushing levers. For cutting the thread, the boring bar had a screw thread the pitch of that to be cut, on which was clamped a two part nut secured to the upper guide of the boring bar. When a cut was run through, the cutting tool was brought back by the men reversing the di-

rection. At the time I am writing of, this primitive mode of boring was followed by Patrick Lyon, the then celebrated builder of fire engines in Philadelphia, for boring his brass engine cylinders.

As to how long this primitive process of press screw making was carried on after the time I am alluding to, I have no way of knowing with certainty. I have an impression that Mr. White died before 1821.

I recollect a curious incident connected with these screws: The house of which my grandfather was head received through the Spanish Consul resident in Philadelphia a letter of inquiries as to the cost of a large number of wrought iron screws, a peculiarity of which was they were to be forged solid, then bored out, leaving a certain thickness of shell, the hole closed by a well fitted plug secured by a screw tapped half in the shell and half in the plug. Other peculiarities were explained by the Consul as a necessity to secure lightness, as they had to be transported long distances either on asses or llama backs. The order came, the screws were made, and shipped through a Philadelphia drug house having extensive commerce with South America. At the same time was shipped by Cadwalader and O. Evans machinery for a flour mill. Some years afterwards, when the old United States Mint on Seventh Street was being dismantled, the machinery broken up and sold as old metal, I noticed among the rubbish some old rusty, battered, hollow screws, that reminded me of the screws made by White. I stated the circumstance of that order to Mr. Adam Eckfelt, the then coiner. He smiled, and said he could tell the sequel. It was like a sermon of three divisions and finally: Firstly, when the screws were made, from some cause mercury was cheaper in Philadelphia than either Spain or South America. When produced, the hollow screws were filled with mercury, and in that condition reached the gold mines. The secondly was, after the mercury was run out, the hollow body was made to take the place of an ingot mould and cast full of gold, the plugs returned and securely riveted, some bent and broken, all badly rusted, and with other pieces of machinery were safely transported to the seaboard shipping port, having offered no attraction to brigands who infested all the roads. The thirdly was, as old machinery and waste metal they passed the Custom House and evaded a heavy export duty levied on all gold shipped to any other country than Spain; they also got cheap transportation and safety by vessel to Philadelphia. The finally was the golden harvest at the old United States Mint. They had answered the purpose of the projector, had brought into our country over $150,000 that otherwise could not have reached it in a direct way. They had left their maker's hands at a cost probably not exceeding $30 each, and returned after their long travel by water and by land, each carrying within its old, battered, rusty shell over $5,000 of pure gold. Some of these old screw shells should have been preserved as relics of Yankee ingenuity, for it was all the work of an American who had found his way to the gold mines in the mountains of South America. The humor of the thing was making the Spanish Consul, probably an innocent party to the fraud against their customs, act as a go-between in the entire transaction.

We learn from an exchange that Mr. Potter, of Titusville, Pa., is to begin the manufacture of a new rotary engine in which he is to get over 70 per cent. of the power. Why not put it at 100 per cent.?

Politeness Being Acquired at West Point.

It will be remembered that last November, when a request was made for permission to admit the Society of Mechanical Engineers to visit the military school at West Point, General Merritt, the officer in charge, gave a curt refusal, but was eventually persuaded to admit the society. Those who availed themselved of the ungraciously granted privilege and went to see this Government institution, got little satisfaction from the visit, for the officers of the place treated the visitors with the discourtesy of studied neglect. We suggested at the time that a professor of good manners was needed at this military school. This, or something else, must have effected a wonderful change in the demeanor of General Merritt and his underlings since then, if we are to judge from the way they have lately received some visitors. Last week an excursion of Vassar College students (young ladies) visited West Point, and nothing could exceed the politeness of their reception, and every effort was made to render their visit enjoyable.

The excuse made in first refusing the mechanical engineers admission was that the presence of visitors would interfere with the studies of the boys. Of course, no danger of this kind was to be apprehended from a crowd of young misses! Their romping round the establishment would have no distracting effect, compared to the presence of a body of engineers! It is to be hoped that this incident indicates a growth of politeness among our military coxcombs.

In recommending that the Government purchase the torpedo boat Destroyer, the Secretary of the Navy voices the sentiment of the whole country. Captain Ericsson has done many things for which the American people are grateful, and there is every reason to believe that the principle upon which the Destroyer is constructed is correct.

Form and Material of Boilers.

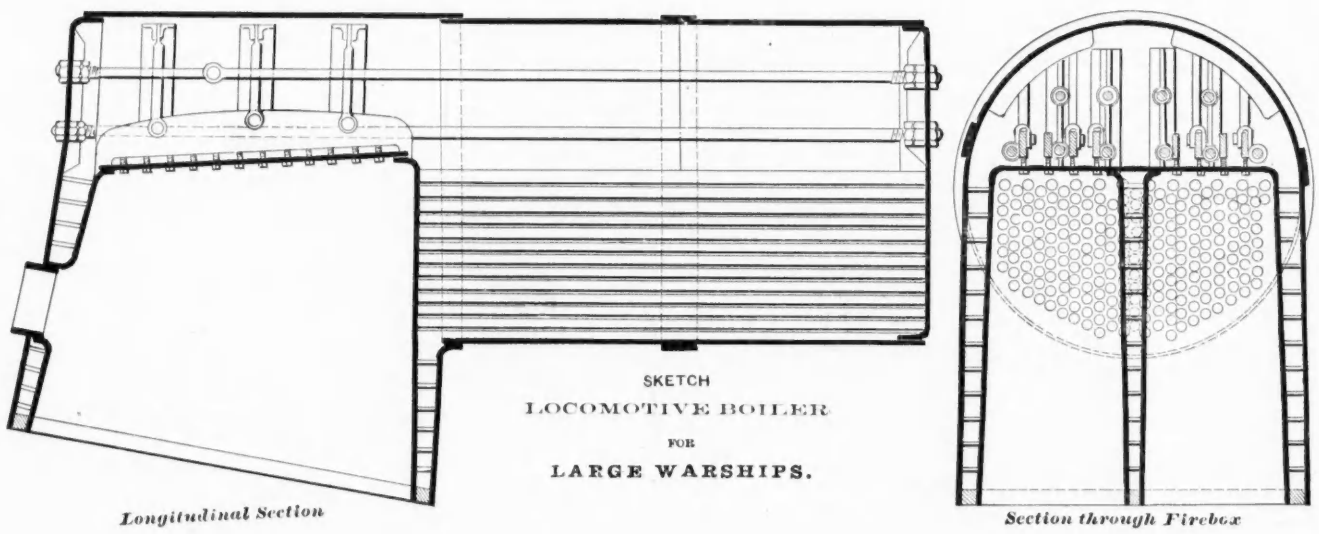
BY GEORGE MARSHALL.

LOCOMOTIVE BOILERS IN MARINE SERVICE.

In a recent number of the AMERICAN MACHINIST reference was made to the use of a locomotive boiler in one of the ferryboats belonging to the New York, West Shore and Buffalo Railway Company, and the statement made that it was found to be more economical than the marine boilers in the other boats, and that it was intended to allow it to remain permanently to do the steam-making for engine purposes From the tone of the article referred to, I supposed that it was looked upon as an innovation on established customs, and entirely a new departure in marine steam generation; while, in fact, the use of this type of boiler for marine purposes, and even for large war-ships, has been in vogue in the British navy for some years.

A reference to the accompanying sketch will show that some slight but unimportant changes in the general appearance of the ordinary American locomotive boiler has been made, and the furnace divided by a center water leg not quite extending to the fire-box tube sheet. Boilers of this form are in use by the Baltimore and Ohio Railroad Company, but I think with a single furnace. In England this type of boiler is used "to utilize the advantages of forced combustion," and, it is claimed, with great economy in the use of fuel. As it takes about one-quarter of the available heat of combustion to produce a chimney draft, the greatest heat produced by natural draft is about 2,240°; while with forced draft, and with half the quantity of air for dilution, the temperature is equal to 3,200°. The utilization of advantages of forced combustion is not, however, an English idea, it having been used by Prof. R. H. Thurston many years ago, as well as by the late R. L. Stevens. It is claimed for the locomotive boiler and forced draft, when used for marine purposes, that the present great hatchways, fire-rooms and engine-rooms can be, in a great measure, dispensed with; smaller boilers could be used, leaving greater space for bunkers along the sides and over the fire-rooms; the height of the smoke-pipes could be greatly reduced, and for war vessels, if desired, dispensed with, as the products of combustion could be delivered through proper openings at the sides of vessels just below the deck, and for the same purpose, the boilers being so low, would place them beyond the range of shot or shell from the enemy's guns.

In a paper read before the Society of Engineers and Ship-Builders in 1879, the following favorable comparison to the locomotive boiler was given by the author, Mr. Josiah McGregor:



Longitudinal Section

SKETCH
LOCOMOTIVE BOILER
FOR
LARGE WARSHIPS.

Section through Firebox

	TYPE OF BOILER.	
	CYLINDRICAL.	LOCOMOTIVE.
Diameter	8 ft.	4 ft. 9 in.
Length	9 ft. 5 in.	15 ft. 5 in.
Furnace	2 ft. 9 diam.	4′ 1¼″ × 6 ft.
Thickness of shell	⅝ in.	⅜ in.
Thickness of furnace	7/16 in.	⅜ in.
Grate area	55 square ft.	50 square ft.
Total heating surface	1,445 square ft.	1,486 square ft.
Working pressure	80 lbs.	80 lbs.
Water steaming surface.	128 square ft.	133 square ft.
Weight of boiler	19 tons.	12 tons 10 cwt.
Weight of water in boiler	11 tons 8 cwt.	9 tons.
Weight of super-heater	1 ton 12 cwt.	1 ton 12 cwt.

It will be seen from a comparison of the foregoing figures, that an increase in the heating surface and water-steaming surface is obtained, and the weight of metal and weight of water reduced by about 9 tons 8 cwt.; while the difference in the relative height of both boilers establishes their superiority in war vessels, where protection is, as it should be, fully considered. My personal experience as a boiler-maker will not justify me in recommending the use of forced draft, as observation convinces me that when artificial means are resorted to, in order to produce combustion, the life or durability of the boiler is greatly reduced.

STEAMERS WITHOUT SMOKE-STACKS.

In regard to dispensing with the smoke-stack, as stated, the Messrs. Yarrow & Co., ship-builders and manufacturers of torpedo boats in England, have recently dispensed with the smoke-stacks in some of their torpedo boats, and, from the fact of Mr. Yarrow having procured patents on several inventions for the protection of the men employed in fire-rooms from injuries resulting from the bursting or serious leaking of tubes, it is reasonable to suppose that forced draft is an established fact in the minds of the firm, and that all of their torpedo boats will in future be constructed with that principle in view. The experience of English authorities has led to the adoption of increased furnaces and combustion chambers for the better attainment of more perfect combustion.

HIGH REPUTE OF MILD STEEL IN ENGLAND.

As stated by me in an article on "mild steel," greater attention is bestowed to the new metal in England than is bestowed on it here, and recent experiments show that a greater uniformity of production is rewarding the English mill owners for the attention given to the quality of their product.

The construction and engineering department of the British admiralty, strongly endorses steel as vastly superior to the best English iron for ductility, its tensile strength being 30 per cent. greater than the best wrought iron produced in Great Britain, while in mean construction steel has an average of 49.1 per cent. against 20.6 for Yorkshire wrought iron plates. They also report that mild steel is cheaper than the best wrought iron for the construction of hulls and boilers, while the principal surveyor to Lloyd's Registry says that out of a total of four thousand steel plates, only ten or fifteen have been condemned, and these not because of inferior metal, but solely on account of negligent or improper manipulation, while he has found it by no means uncommon to reject ten or twelve plates out of the number required for one boiler. As improper manipulation of steel prevails here as well as in England, the following instructions, published by the Steel Company of Scotland, may be of interest to your readers who are practical boiler makers:

1. Welding.—In welding mild steel plates it is not necessary to heat them to the same high temperature as in the case of iron; instead of a welding heat, a bright yellow heat is sufficient; and if flux is required, it need only be three parts clean sand to one part common salt, moistened and thrown on the parts in the fire. We recommend that the weld be of the V form in preference to the lap, and that it be treated in the usual way, that is, light hammered on the V part. After the weld is made, and while the heat is good, the parts near and on either side of the weld should be lightly hammered. In making the weld, the fuel used should be free from sulphur, otherwise red shortness may result.

2. Flanging.—In flanging care should be taken in the local heating that the parts are not overheated, and that no hammering or work is put upon them while at a black heat; further, it would be well if work could be continuous until each flange is completed, or, if the plate has to be laid aside before it is finished, it should be protected from chills, if it be not convenient to keep it warm.

3. Annealing.—After completing either welding or flanging, the whole piece should be heated to a cherry red heat and slowly cooled.

4. Orders.—In ordering steel plates care should be taken to state the purpose for which they are to be used, especially in cases where they are required to weld and flange.

The care taken by the same company to prevent defective plates being shipped from their works is also illustrated by the following account of one of their tests: "A man is stationed by the shearing machine whose sole duty is to take a portion of a shearing from each plate, heat it to a cherry red, cool it suddenly in water, and then bend it, observing closely the effect on the piece of steel. The plate is rejected if the test is not satisfactory. This test affords a ready means of detecting a brittle plate, which, from having been well annealed, might have passed the cold bending test without discovery."

PREVENTING SCALE IN BOILERS.

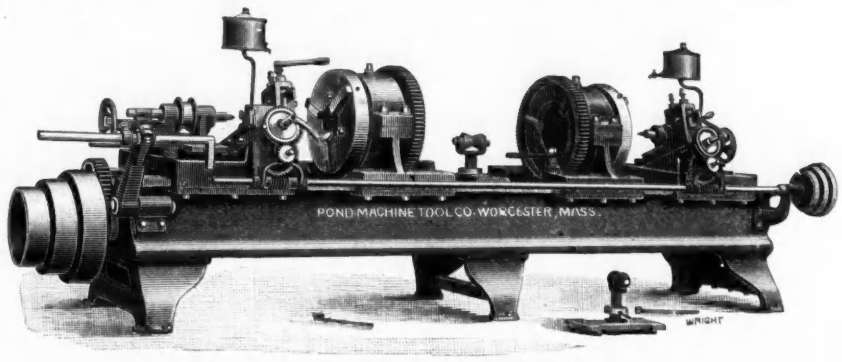
Your correspondents occasionally seek information as to a proper preventive of corrosion and scaling in their boilers. I would here state for their benefit that zinc is highly recommended by English authorities as a preventive of both. The use of zinc for this purpose is not nor has it been confined to English engineers, as I knew of its frequent use by engineers in New York and Brooklyn ten years ago, and with satisfactory results. The quantity should be governed by the size of boiler, yet experience alone will enable the user to achieve the best results, as the impurities of water vary in different localities, both as to the quantity and quality of solid matter held in solution, and the temperature required to precipitate may in some cases be obtained by the use of a heater, while in others live steam alone may be able to accomplish the result.

London Watchmaking Suffering from American Competition.

The natural connection between watchmaking and ballooning is not obvious, but it appears that the principal masters in the watchmaking business of London belong to a balloon society. At a recent meeting of that society, æronautic subjects having run short, Sir John Bennett, a leader in the watchmaking trade, an active politician, and an ex-Lord Mayor, introduced the topic of watchmaking for discussion. Along with several other speakers, equally well posted, Sir John maintained that the American and Swiss watches were being so successfully introduced into Britain that they were pushing English-made watches out of the market, even in London.

It seemed inexplicable to the speakers, how watches made by American high-priced labor could be sold cheaper than watches made in London; and the explanation given was that the American watch was an inferior article, which was preferred by short-sighted ignorance. But that this watch was being preferred was certain, and the matter has become so serious that some means must be sought to remedy the evil. Sir John admitted that the business of making time-keepers in England was in a most desperate condition of decline, and he declared that unless something effective were soon done to counteract the American and Swiss competition, the British article would be extinct in a few years. The meeting resolved to call upon the Government to appoint a commission to inquire into the subject, and to devise remedial measures.

We can tell Sir John Bennett and his friends what a Government commission will find out, if they investigate the subject properly, and we might be able to indicate the true remedy. For years the American watch and clock-making trade has been developed on sound mechanical principles. The interchangeable system of machine work invented by Eli Whitney, and applied by him so successfully in armory work, was adopted by American clockmakers many years ago, and the success of the trade has been due to the exact reproduction of parts by special tools, and ingeniously devised machinery. England got an excellent start of other countries in the department of hand-made clock and watchwork, and the masters and men got to believe that in this line they could beat all creation. When our makers, relying on special machinery, began to push English makers in the trade, the latter, instead of adopting the methods of their rivals, regarded the matter as a piece of American assurance that would soon meet defeat.



DOUBLE CUTTING-OFF AND CENTERING MACHINE.

The weakest goes to the wall here, as in all other departments of industry, and hand work cannot compete with machinery. No Government commission can cure the distemper the English watchmaking trade is suffering from. The remedy must originate within the trade. If Sir John Bennett and his watchmaking colleagues will give ballooning a rest and devote their energies to reforming their trade methods, it will do more to rescue the London watchmakers' business from extinction than the work of ten royal commissions.

Double Cutting-Off and Centering Machine.

In this machine the axles or shafts to be cut off square and centered are held in self-centering chucks, which will admit shafts as large as 8″ diameter. These chucks are adjusted to distance on the bed by means of rack and pinion, and are driven by cone and double gearing, giving three changes of speed, any of which may be quickened as the cutting tools approach the center, which virtually increases the changes of speed to six.

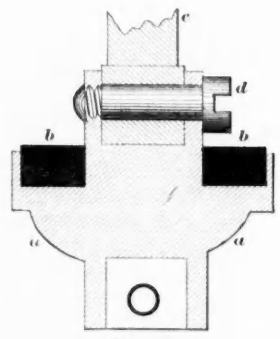


FIG. 3.

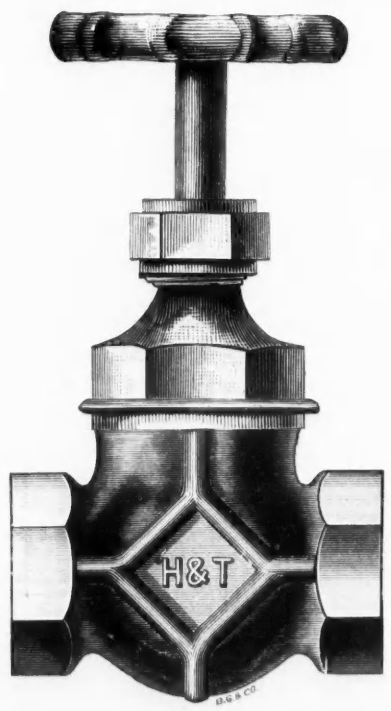


FIG. 1.

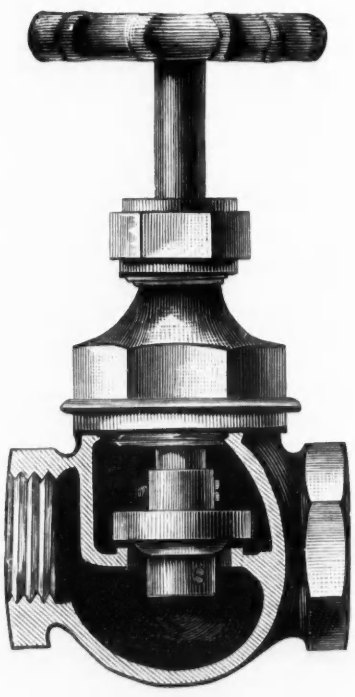


FIG. 2.

The tool slides are adjustable by rack and pinion to any length of shaft, and may be operated either separately or together, each having three changes of power feed, and also a rapid hand movement, quickly changed from hand to power feed.

The centering heads with revolving spindles are driven by separate countershafts. Both ends of shaft may be drilled at once. The heads slide aside while the shaft is being put in the lathe and cut off.

The bed of this machine can be made of any required length. The machine is furnished complete, with countershaft, water can, swivel rollers, wrenches, etc. The manufacturers are the Pond Machine Tool Company, Worcester Mass.

George Westinghouse, Jr., is in Colorado attending to the application of the air brake to freight cars on the Atchison, Topeka and Santa Fè Railroad. So far as the work has been carried out the application of this brake to freight equipment has been very successful, the acceleration of trains due to its use promising in a great measure to defray the expense of putting on the brake and maintaining it in good order. Mr. Caird, of the Westinghouse Brake Company, is now in Mexico urging the government of that country to adopt the brake for the freight trains on the National Railroad. On two railroads running into the City of Mexico the air brake has not been applied even to the passenger cars, but it is expected that they will adopt the brake soon.

New Double-Seat Globe Valve.

The globe valve illustrated herewith is a new one just brought out by Holland & Thompson, Troy, N. Y. Fig. 1 is an elevation, from which it will be seen that the case or shell is made with ribs or projections on its outside, which in addition to strengthening it make it very neat in appearance.

In Fig. 2 the shell is shown broken away, exposing the seat and valve or disk. The seat has both a ball and a flat surface. The disk is loose on the stem, being loosely held in position by means of a small screw. As represented in the engraving the disk is on the stem in position to cover the ball seat. By reversing the disk, that is by turning it end for end, which can be done very quickly, it will be in position to cover the flat seat.

In the small cut, Fig. 3, *a* is the disk, fastened to the stem *c* by means of the small screw *d*. The surface of the disk opposite the balled part is chambered for a flexible ring *b*, which when the disk is reversed makes a joint on the flat portion of the seat. This construction affords the advantage of a hard or a flexible valve, as may be best under the conditions of use. Also if one of the seats becomes injured the other may be used.

The *Worcester* (Mass.) *Spy* says: "The Worcester Association of Stationary Engineers had a very spirited and interesting meeting Wednesday at their new rooms, No. 302 Main street. Quite an extended debate was had on the subject of clearance, which will also be in order for debate at the next session May 28th. They were presented last evening with a large and beautiful illustrated Bible by B. D. Preston, one of the members. A very cordial interest is being manifested in the association by the manufacturers, and a goodly number of them are already enrolled as honorary members."

LETTERS FROM PRACTICAL MEN.

Making a Toy Locomotive.

Editor American Machinist:

Allow me to take exceptions to some of your conclusions in your article on "Making a Toy Locomotive." You state that the work is not so small as numerous operations in watchmaking, and can have no value as a specimen of miniature workmanship. True, we will grant that the work may not be so fine in some respects, but when we consider that watchmaking is but a series of operations with which, from long practice and daily repetition, the workman becomes familiar and expert, and that the building of a locomotive, large or small, must bring into play an intimate knowledge of steam science and the exercise of quite a number of mechanical trades, you will readily see that the building of a locomotive and the making of a watch, or other similar work, are two radically different things.

The making of a successful small model locomotive combines operations and fittings far more difficult to perform than the smallest watch work, and some credit is due the person who has the patience and skill to build such a model. I speak from experience on this point, as I have done similar work myself.

While I do not approve of any mechanic spending ten hours a day for three years in making a toy locomotive, or other small model containing no new idea, I do contend that such work done at the proper time and under proper conditions is not a loss, but a direct gain both to the mechanic and the community at large. As a means of recreation and education, there is nothing superior to it, and every mechanic who can afford it should have a small lathe and tools, with which he could occupy his leisure hours in designing and building small machinery, etc.

Such work is the true education of the mechanic. It tests and develops his originality, his taste, and his constructive skill. In the shop he is under his foreman's orders, and does as he is bid. His ideas are restricted to the work in hand. Out of the shop he is free to think, to plan, and design. His ambition is stimulated to do a creditable piece of work; he bends all his energies to that end, and, mark my words, if there is anything in him it will come out. He becomes accustomed to delicate workmanship, fine fitting, the designing of machinery, the strength of small parts—in fact, a finer mechanic and a better man, and an advantage to the community at large.

I have but little sympathy with the prevailing idea of the age—that all labor whose immediate outcome cannot be computed in dollars and cents is utterly thrown away.

Some of the finest achievements in mechanical science have had their origin in that source. F. VAN FLEET.

Williamsport, Pa., May 23, 1884.

Melting Small Quantities of Iron.

Editor American Machinist:

The following plan for melting 100 to 300 pounds of iron in a common ladle I respectfully dedicate to Thomas D. West (as one of the odd methods of melting iron) for his second volume of "American Foundry Practice." I imagine I can see a smile illuminating the features of the moulders in some of the finely equipped foundries, where they melt from twenty to fifty tons of iron per day, at the idea of melting a couple of hundred pounds; still, there are hundreds of small shops where the knowledge of a method for doing so would be a source of considerable profit, besides sometimes retaining a customer. For instance, Mr. E. has a small shop, and only casts once or twice a week; a short distance from him (perhaps in the same town), D. & Co. have a large shop, and cast every day. E. has just taken off a heat, and will not cast again for several days, when in walks a customer with a broken-down job that will require from 100 to 250 pounds of iron to pour off, and he *must have it immediately.* E. doesn't want to lose the job, or run the risk of losing a customer. Now for the plan for doing the job and retaining the customer: Take a common 300-pound ladle, *A*, daubed in the ordinary way, and "fire it up" until you have a solid coke or coal fire. Then take a plain cylinder, *B*, made of light boiler iron, 36″ long and of the right diameter to fit the top of ladle. This cylinder should have a 2″ hole at one end for tuyere pipe, and should be daubed up same as a ladle, and dried ready for use. Place the cylinder top of ladle, daub up around the joint, and add fuel until you have a good bed 6″ or 7″ above tuyeres. Put on such iron as you wish to use, and as much as you need to pour off the piece. Nearly all small foundries have tuyere pipes that can be detached from the cupola without much trouble, and used for blast by adding a small piece of pipe to fit tuyere hole in cylinder. After the iron is down, lift off stack and pour as usual. By this method a ladle holding 300 pounds can be melted full of good hot iron in a short time.

Permit me to say to M. H. F., who inquired about a ladle in your issue of May 17, that hand ladles of that style, having a spout daubed inside and pouring the iron from the bottom of ladle, have been used for several years to pour small light castings that have to be clean for plating.

Columbus, Ga. ROBERT E. MASTERS,
Foundry Foreman, Columbus Iron Works.

The Gouverneur Boiler Explosion.

Editor American Machinist:

The article in a late number of AMERICAN MACHINIST, by Mr. Marshall, on the recent steam boiler explosion at Gouverneur, N. Y., contains much valuable information that is worthy of more than passing notice; and one point in particular seems to confirm an idea given expression to, in rather a blunt way, in an early number of your paper, viz: "most boilers explode because they are too weak to stand the pressure."

As this sentiment is somewhat a hobby of the writer's, it may not be out of place to call attention to it again at this time, though some information contained in a former article is repeated.

Here, according to Mr. Marshall's paper, we have a boiler, the shell of which is, or rather was, 54″ diameter, made of a very poor quality of five-sixteenth-inch iron, upon which there was a known gauge pressure of 110 lbs. When it is generally conceded by our most eminent engineers that 5,000 lbs. per square inch of section is the greatest strain that should be put on the very best quality of iron, when used in a boiler, it becomes an interesting question to determine what strain these boilers were subjected to.

Then, by the formula previously given, we have $54\times110\times3.2\div2=9{,}504$ lbs. per square inch of section; nearly double the safe limit.

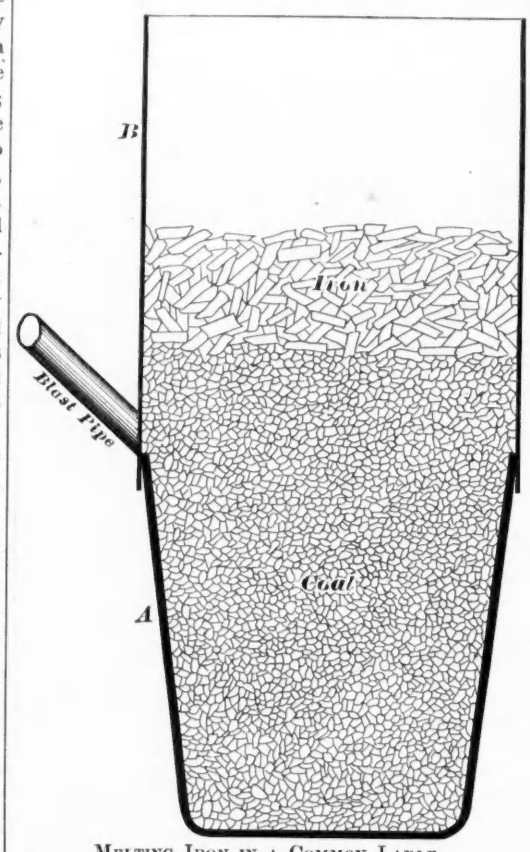
Would it not bring more sunshine into our homes to pay greater attention to these questions of excessive pressure before the explosion takes place, rather than to theorize about the mysterious cause of the explosion after life has been sacrificed. W. H. ODELL.

Cleaning Boiler Tubes.

Editor American Machinist:

I noticed in your issue of May 31 a machine for cleaning boiler tubes. Our plan for the same purpose is: Throw the whole pile into a machine such as is used for cleaning castings in a foundry, throw in a lot of cupola cinders with them, and set the whole revolving. They then clean themselves by rubbing against each other. It requires no attention, and about two hours' run will clean the dirtiest kind of a flue. This plan is not new, but may be new to some of your readers, and is worth trying.

Indianapolis, Ind. B. F. HETHERINGTON.



MELTING IRON IN A COMMON LADLE.

There is a large equipment of machinery in the basement of the large Produce Exchange Building, New York. A Straight Line engine is used for running the dynamo for electric lighting, and there are six Worthington pumps for pumping water needed to operate the elevators. There are nine large elevators that are kept continually at work during business hours. Three Knowles air pumps are at work operating pneumatic tubes belonging to the telegraph companies. At present the steam to operate the engines and pumps besides that used for heating the building is received from the New York Heating Company, but preparations are being made to put Babcock & Wilcox boilers into the building.

The New York and New England railroad superintendent has issued an order that all men who couple cars must use a coupling stick, and that the company will not be liable for any accident when the stick is not used. The order and a stick are given to each employe, for both of which he is made to sign a receipt.

A Brooklyn man who hit wheat for a few thousand dollars last week, rushed around and rented a brown-stone front, and then sought the services of a furniture mover. "I'll take it by the job and do the fair thing by you," replied the mover. "Well. how fair?" "I'll say fifty dollars for the two." "What two?" "Why the moving this week into the brown stone, and the moving, in about a month, from that into a cheap frame house in suburbs? I always job the two moves together in the case of a grain speculator!"—*Detroit Free Press.*

American and Foreign Art.

Our free trade contemporaries are expressing themselves terribly harassed over the defeat of the bill to admit works of art without paying duty. With sorrow that is not unmixed with satisfaction, they announce that the legislative blindness of protectionists is going to be punished by the contemptible treatment of American artists. Already they say that Italy has intimated a firm readiness to retaliate by excluding American artists from Italian art collections, and the suggestion is made that French artists close the salon against American rivals. All this would no doubt be regarded as a dreadful calamity by those worshippers of foreign work who can perceive no merit in anything unless it be "imported."

America is the best market of French and Italian art, and if the producers object to our methods of accepting their work, there might possibly be means devised by bringing them to the consciousness that our money is as important to them as their art work is to the life of this nation. A great part of French art works imported are engravings of pictures that could be done better by our own artists, were it not that the demand calls for a foreign-made article, even if it be inferior to those produced at home.

What this country needs, urgently, is the cultivation of a sentiment that will try to do justice to the productions of native artists and workmen, and discourage the slavish worship of everything inanimate made abroad. While foreign publishers readily admit that they cannot produce engravings equal in merit to those used in American art and mechanical journals, because the best talent leaves them for America, our buyers of engravings go in ecstasies over the beauty of French-made cuts that good American engravers would be ashamed to acknowledge.

Portable Railways.

At a recent meeting of the British Institution of Mechanical Engineers a paper was read on portable railways by M. Decauville, a French engineer, who has experimented with a peculiar form of track designed by himself. The track used was ordinary single-headed rail, of a light pattern, riveted to disk-shaped metallic ties, each length of rail forming a distinct portable section. The ties were made with ample base, which gave a good foundation to the track in soft ground. The chief advantage claimed for this form of temporary track is its firmness, besides being convenient to handle quickly. As there are no bolts, spikes or movable parts to fasten and keep in order, the cost of maintenance is light, and it can be put together quickly. Railways made in this way are in successful operation on large earthwork contracts in different parts of the European Continent. They have also been used in French military operations with the best results. One of the lines built in this way in Tunis, for military purposes, is now being successfully operated as a permanent road, and is forty miles long. The gauge for these roads is generally about 16 inches, but a width of 24 inches has been chosen where the work was heavy.

An ordinary slide valve the lap of which is equal to one-quarter of its travel will, without lead, cut off (average of both ends) at three-quarters stroke.

The Farmer Drill.

This drill was originally designed more especially to overcome certain difficulties experienced with common drills when used in the lathe or for horizontal drilling, such as drawing-in and running-out of true when coming in contact with blow-holes, seams, etc., or in tearing through the metal when the hole is nearly drilled, and many other defects equally vexatious. A little experience, however, with these drills not only proved that they would obviate all such difficulties, but showed they were particularly adapted to fill other and important offices. Owing to the peculiar shape of this drill, with its grooves extending beyond the center, thereby giving a full, straight lip from point to periphery, together with its sharp parallel edges extending the entire length of the grooves, it has, to a certain degree, the advantage of a reamer, for which purpose it can be most successfully used. It is also valuable for counter-boring, counter-sinking, slotting (by boring one hole into another), for drilling out irregular-shaped holes, holes out of true, and in truing up holes not perfectly straight. Also in drilling where holes cross at angles, or intersect one another, and through tubing and cylindrical shapes, drilling through one material into another, from hard to soft, or *vice versa;* and between two substances of a different nature. As it will not catch or run forward, and as it is strong, there is little danger of breakage when running at high speed.

This drill being found valuable for the purposes named, there came a demand for it with taper shank, to be used in the drill press, and lately they have been used almost as much for vertical drilling as for the lathe. These drills have also met with favor in repair shops, where, besides ordinary work, they are used for such purposes as drilling out old threads in holes to be retapped, slightly enlarging bolt holes, drilling out studs, rivets, and screws that have rusted in, etc.

It is also used to advantage for boring out cored holes in castings, and can be used with correspondingly good results as a "chuck drill." The larger sizes are also being successfully used in the new radial drilling machines and in boring mills.

In such branches as the manufacture of saws and sheet metal work, where many

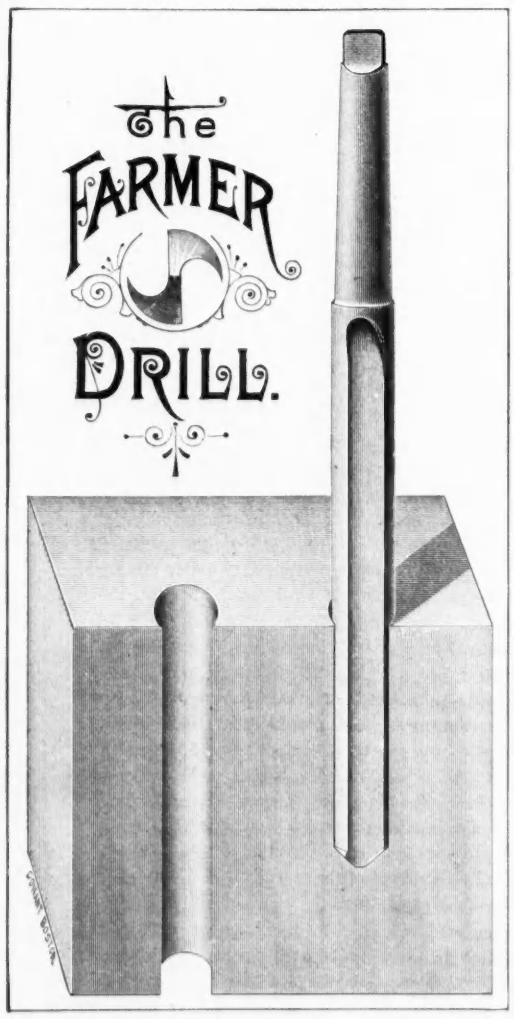


FIG. 1.

thicknesses of steel, iron, or other thin materials are to be pierced at one drilling; in stove and other work in which thin, delicate castings are used, these drills are much used. They are also in demand by electric light companies, manufacturers of chandeliers and gas fixtures, ornamental brass workers, electrical and astronomical instrument makers, and watch and clock factories. The smaller sizes are used by shops working such substances as bone, ivory, shell, and hard rubber.

These drills are easily ground, requiring no especial care to keep them in order, and no great amount of skill in using them, making them an economical tool when placed in the hands of inexperienced workmen.

In the manufacture of these drills of small sizes, the stock is cut to length and placed in quantities in a receptacle at one end of an automatic self-feeding milling machine, no attention otherwise than replenishing the stock being required.

They are then ground (after hardening) by being placed on centers in a machine where, by an oscillatory motion, the relief or backing-off the full length of the groove is performed. When this is accomplished the oscillatory motion automatically ceases, and the drill then passes the wheel, by a reciprocating motion, its entire length, including the shank, thereby insuring accuracy and uniformity from end to end. A similar machine is used for producing taper shanks. The system of gauges, employed for keeping up the standard of sizes, is quite complete.

The accompanying engravings fairly represent some of the uses to which these drills can be applied.

Fig. 1 represents the drill boring a hole close to the edge of a block of metal, so that one third of the drill projects beyond the surface, showing there is no tendency to run out or depart from a true course; also gives view of cross-section and point.

Fig. 2 shows specimens of counter-boring, also holes crossing at angles or intersecting one another.

Fig. 3. A slot, made by drilling several holes one into another.

Fig. 4 is an impression taken directly from a block of brass, and is a sample of what can be done with these drills.

These cuts do not illustrate drilling done by experts, as similar work can be accomplished whenever occasion requires, in any shop, and by any man of ordinary intelligence, the only requisites being a good chuck, a true spindle, and a moderate amount of brains, the drill taking care of itself.

These drills are manufactured by the Union Twist Drill Company, of Boston, Mass., who will in the future confine themselves exclusively to the production of the Farmer drill.

The Mechanical Engineers at Pittsburgh.

Fair weather, an interested attendance, and the efforts of the local committee and the manufacturing, mechanical and engineering fraternity of Pittsburgh, combined to make the recent meeting of the American Society of Mechanical Engineers at that city one of the most pleasant and profitable yet held. Pittsburgh, as a great manufacturing city, is full of things of interest to engineers, and the badge of the society was potent to secure admission to places not always open to visitors. Considerable time—two days out of four—were given up to excursions, besides which one afternoon was devoted to individual sight-seeing. In addition to this many members arrived Tuesday morning, thus having a full day at their disposal before the sessions began. A specially prepared map, with various manufacturing establishments that offered the freedom of their works to the visiting engineers located upon it, was of assistance in selecting routes, and with the attention of local engineers and others made everything with respect to finding one's way as complete as it could be in a city that seems to have neither names nor numbers to its streets.

Thursday the members were tendered an excursion by rail up the Allegheny River on one side, and down the other, a special train provided with an excellent commissary department, conveying them. During the outward trip the Isabella furnaces were visited, each of the two stacks of which has a capacity of about 200 tons of iron per day. A noticeable feature at these furnaces was the neatness and order that prevailed everywhere—something rarely seen at works of the character of these. The Spang Steel and Iron Company's Works were also visited during this stop.

The next stop was at the immense plate glass works, covering fifteen acres of ground. Natural gas is used here as fuel, and the process of making plate glass 126″x186″ was a subject of general interest. Further along

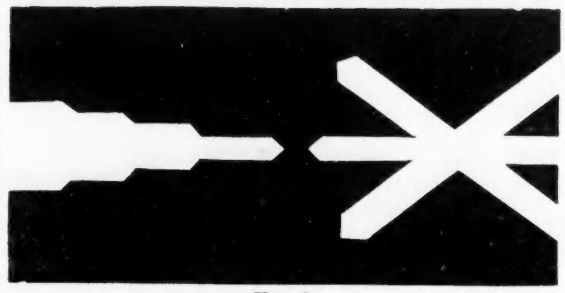


FIG. 2.

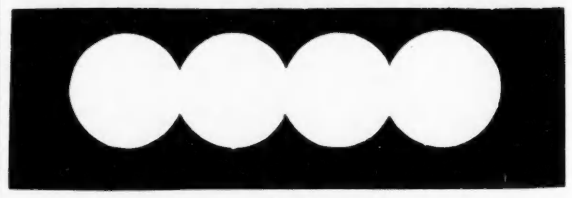


FIG. 3.

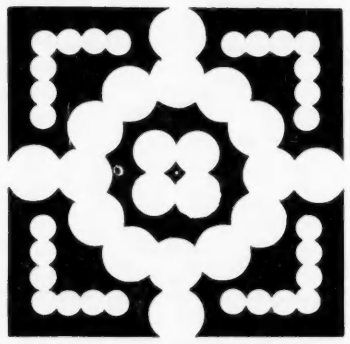


FIG. 4.

the soda works were visited, the processes of manufacture in which were too much for the understanding of the average mechanical engineer.

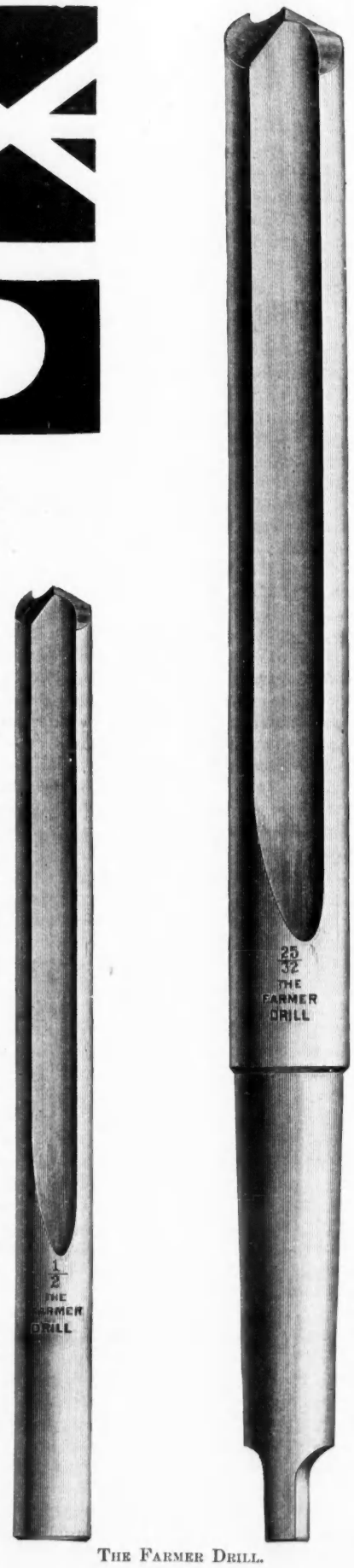
At Freeport the train crossed the river, and, returning, the water works at Brilliant were visited. Here are situated the large pumping engines of which so much has been said, for and against. The celebrated Lucy furnaces were visited during the return trip. These are of about the same capacity as the Isabella. The working of the hoist at these furnaces attracted a great deal of attention. In this the charges are hoisted, by engines at the top, up an incline departing but little from the perpendicular, and having a length of about 180 feet, a load for the car being 2,800 pounds. Arriving at the top the load is automatically dumped in the furnace, and the car returns for another load with the precision of an automaton.

The Crescent and Black Diamond Steel Works, the Keystone Bridge Works, and the Porter Light Locomotive Works, were also overrun during the return trip, at all of which places the visitors were accorded every privilege for examination.

On Friday there was an excursion by boat up the Monongahela River, calling at the Cold Rolled Shafting Works of Jones & Laughlins, the Miller Forge Company's shops, the Edgar Thomson Steel Works, and other industrial establishments. At the forge works a large slotter, by Hewes & Phillips, and a long and heavy lathe, by Pond, were a part of the plant. The excellent facilities of the forge for doing heavy work received favorable comment. The steel works were overlooked as well as their magnitude and the limited time would admit of. These are the largest and most complete works of the kind in the country, representing the investment of several million dollars. A substantial dinner was served on the boat.

During the return a session of the society was held, a paper by Mr. Barrus being read and discussed. This excursion closing the Pittsburgh meeting, after the regular business was disposed of, the members indulged in singing "Auld Lang Syne," and several of the members were impressed into making short speeches, acquitting themselves in a way to provoke universal merriment and good feeling.

Amongst the places visited by parties of engineers, were the Westinghouse Machine Company's shops, the shops of the Air Brake Company, and the Pittsburgh Locomotive



THE FARMER DRILL.

Works. At the latter place strangers were surprised to find the best arranged and equipped locomotive works in the country. Mr. Weightman, the superintendent, personally escorted his guests through the shops, the excellent arrangement of the plant, which has grown up under his supervision, being universally commended. A new building for patterns, which is about finished, and which is divided into fire-proof compartments, was conceded to be perfect in its arrangement.

The Westinghouse Machine Company's Works are entirely devoted to building steam engines, and are running nights to keep up with orders. One of the largest-sized engines built at the works was seen ready for shipment to Australia, to be used for driving an electric lighting plant for the Government of New South Wales. Many matters of interest in the way of appliances for special work, both in the machine shop and foundry, well repaid a visit to these shops.

The Air Brake Works have, perhaps, the most complete machine-shop plant in Pittsburgh. The operations of making and testing the brake appliances were shown and explained by the superintendent, so that those, if any, who were unacquainted with the working of one of the most valuable appliances used in railroading came away with a good knowledge of it. Many very fine special tools are used, and the work done is of a high character.

Copper Fire-boxes in Britain.

For some years back the steel makers of England have devoted great attention and care to the improvement of mild steel, and they have succeeded in making plates almost uniform in the quality desired. In view of this fact it seems singular that locomotive builders there still continue to use copper fire-boxes and brass tubes. In a communication to the American Master Mechanics' Association last year, Mr. Webb, locomotive superintendent of the London and Northwestern Railway, attempted in a curious way to explain why British engineers did not adopt steel fire-boxes. He said that steel sheets if made heavy would not stand the intense heat of combustion in their locomotive fire-boxes and if the sheets were made thin they wore out too readily. We believe the real cause why steel has not been adopted by British locomotive builders is because they have never tried steel of the right quality and thickness. The heat in an American locomotive fire-box is generally much greater than is common with English engines, and steel is more satisfactory than copper because the proper kind of plates is selected. If British locomotive builders would try plates of the same kind as our makers use and anneal them properly before working they would soon come to abandon copper fire-boxes.

The Secretary of the Treasury has approved so much of the Amendment to Rule 36, adopted at the last meeting of the Board of Supervising Inspectors, as is contained in the following paragraph:

"Spring loaded safety valves, constructed so as to give an increased lift by the operation of steam, after being raised from their seat, or so as to give an effective area, equal to that of the aforesaid [ordinary] safety valve, may be used on all marine boilers, and shall be required to have an area of not less than one square inch to three square feet of grate surface of the boiler, and each spring loaded valve shall be supplied with a lever that will raise the valve from its seat a distance of not less than one-eighth the diameter of the valve opening."

There has been considerable controversy over this rule, and it was only acted on by the Secretary after carefully considering all that had been said and written on both sides of the question.

Atkinson, Me., has a blacksmith who keeps a dentist's chair in one corner of his shop and pulls occasional aching teeth. He is also a good cabinet-maker, and when he can't get anything else to do he practices law. There is some advantage in being a jack-of-all-trades when times are dull.

President Fallis, of the Eureka Iron Company, Oxmoor, Ala., says that counting the interest on the capital invested, and for wear and tear of machinery, &c., it costs his company $11 a ton to make pig iron.—*Baltimore Manufacturer's Record.*

Pittsburgh Meeting of the American Society of Mechanical Engineers.

The following are summaries of some of the papers read at this meeting, together with brief abstracts of their discussion:

HELICAL SPRINGS.

By John W. Cloud.

Mr. Cloud said, in substance, that a spring was just as legitimate a subject for proper design and adjustment of stresses and strains as a bridge, a machine or any other structure, and data are available which will render it as easy for an engineer to say with confidence how the spring should be made with an assumed factor of safety, as it is to design the bridge or the machine. While the data are not as complete as might be desired, enough are available so that the factor of safety need not cover any greater margin of ignorance than in the average structure. The round bar is the best form of material for springs, and experience has shown that most other forms are unsuited to the purpose. A steel of high elastic limit and low modulus of elasticity is the most economical in weight required for helical springs. The modulus of elasticity is not seriously affected by tempering in oil, which warrants the conclusion that a spring of given design cannot have its rate of compression per [say] 1,000 lbs. altered by this process of tempering. It is possible, however, that the rate of compression may be largely interfered with, and the maximum stress which the steel may be called upon to sustain may be seriously altered by improper workmanship in coiling so as to make the angle of pitch variable when it should be constant. The elastic limit of small tempered bars is higher than that of large ones, hence bars of small size are more economical in weight of steel required than large ones.

In the discussion which followed the reading of this paper, Oberlin Smith wished to inquire whether the springs were tempered outright, or whether the temper was drawn. He thought a good deal of the trouble with springs was in the tempering.

Mr. Cloud could not say. The springs were made by different manufacturers according to specifications furnished, and tempered as they thought proper. The height at which the spring would stand was not affected by the tempering.

Mr. Metcalf, as a manufacturer of springs, was called upon for remarks on the subject. He thought the spring maker was unfortunate. Every one who wants springs knows what he wants, and knows that what he wants is best, so that the manufacturer was inclined to conclude that the best spring was the one his customer wanted. He had considered the strain and stress on springs to his confusion. The stress could be treated in various ways. Springs in use varied in diameter, that is, they were held at the ends and were free in the middle of their length, and hence were not of the same diameter at the middle as at the ends. This different and varying diameter at the middle did not permit of exact calculations as to strength being made. The round bar was undoubtedly stiffer for the amount of metal used than any other section. He did not think if a spring was properly made and tempered that the elastic limit could be exceeded under compression, as before this was done the coils would be closed together. They [the Crescent Steel Works] used an inverted steam hammer for testing springs, by the use of which the coils were repeatedly set up hard together.

Oberlin Smith suggested that a tubular section might possibly be better than any other for springs.

Mr. Metcalf replied that the result of using such a section would be that it would be crushed in use.

ON A PRACTICAL SOLUTION OF THE PERFECT SCREW PROBLEM.

By William A. Rogers.

Professor Rogers said that at the outset it was essential that the term "perfect screw" should be defined. Perfect is a relative term. A piece of mechanism may be termed perfect when it meets all the requirements of the purpose for which it was constructed. After describing the errors to which screws are subject as being an error in the total length; the pitch of the screw for even revolutions not being uniform, and the fact that there may be a gradual increase of pitch up to a certain point, and then a diminution until the amount of decrease is equal to the previous amount of increase, he detailed the most important failures to make satisfactorily perfect screws, and continued: About this time an order was received from Professor Wm. A. Anthony for the construction of a dividing engine for the Physical Department of Cornell University. Upon accepting the order, a shop was fitted up in Boston with tools of the best quality, chiefly from the establishment of Pratt & Whitney, and Mr. Ballou undertook the construction of the engine, mainly from his own designs, and of the screw which is its essential part. The completed machine was shipped in just 35 weeks after the actual commencement of the work; and the screw, which will be presently discussed, was cut and ground in 27 hours from the time the first tracing of a thread was made. It was at that time practically perfect for about 20 inches, and nearly as perfect as it afterward became by the process of grinding adopted. Notwithstanding the fact that the work was done upon a common lathe in which the errors of the leading screw were enormously large, the result showed that the method employed was based upon correct mechanical principles, and was entirely feasible."

This method can be described in a very few words.

Let the reader hold clearly in mind the following. There are:

(*a*) An ordinary lathe, the ways of which have been made as nearly straight as possible.

(*b*) A shaft between dead centers which maintains a cylindrical form during every revolution and every part of a revolution.

(*c*) A microscope provided with Tolle's opaque illuminator for viewing opaque objects, attached to the carriage moved by the leading screw of the lathe.

(*d*) A graduated bar mounted independently of the carriage with subdivisions which are multiples of single threads of the leading screw.

(*e*) A slide moving parallel with the leading screw, by means of a very short and firmly mounted micrometer screw of comparatively large diameter and attached firmly to the carriage. The tool-post is secured firmly to the secondary slide.

(*f*) A mechanical means of determining when the leading screw has made a complete revolution.

The method of proceeding was as follows:

(1) The graduated bar having been leveled up and set parallel to the axis of the screw to be cut, the micrometer of the microscope was set upon the initial line. The lathe was then started with the leading screw "in feed." After the screw had made, for example, nearly ten revolutions, the lathe was stopped and the remainder of the even revolution was completed by hand manipulation. The deviation of the micrometer line from the corresponding graduation upon the bar was then measured in terms of the screw head of the secondary micrometer screw. In this way the errors of the leading screw with respect to the graduations of the standard bar were determined and written down upon a strip of paper pasted to the vertical face of the bar.

(2) The carriage was then started again with the cutting tool in operation and by means of a rough pointer, the micrometer screw working the secondary slide was fed either forward or backward, in accordance with the corrections before determined. Hence, when the even revolution was completed, it would be found that the line of the bar would be nearly under the cross wire of the microscope. This operation was kept up until the screw was finished.

At the completion of the operation of cutting, it was found—

First, That the total length of the screw corresponded nearly with the length of the line standard from which it was cut.

Second, That there were at many points minute irregularities of pitch, due to the fact that the application of the corrections intermediate between the main divisions had not been exactly made.

Third, That the crucial test of the removal of these irregularities by grinding with a brass nut was a complete success. As had been predicted, they were for the most part removed after an hour's grinding.

The method of testing was as follows: Two half nuts with projecting arms resting upon the / \ shaped way were first placed at a fixed interval apart. A microscope was mounted upon one nut and coincidence was made between the micrometer wire of the microscope and a line drawn upon the upper surface of the other nut. It is obvious that if the relation between the different threads of the screw remained constant, the line under the microscope would remain constant. This constancy under a half-inch objective was maintained for about twenty inches. Then the nuts began to separate, and the separation continued until the maximum deviation amounted to about $\frac{1}{5000}$ of an inch; but near the end the nuts came back to their first relation.

In order to eliminate these residual errors, together with what errors might remain which were a function of one revolution of the screw, the following method was employed. The grinding nut was made in halves, in such a manner that a constant relation was maintained between the halves, both in their normal and in reversed positions. By grinding the screw first with the halves of the nut in their normal relation and then in reversed relations, the tendency was to continually work out the periodic errors of the screw, with the exception of minute errors which were transferred from the screw to the nut during the operation of grinding.

In order that the nut might grind without disturbing the general relation between the threads, a cast-iron cylinder with a center at the bottom was filled with the best sperm oil, and the screw was mounted vertically upon this center. At first two broad fans were attached to the nut in the hope that the resistance of the oil, which in this case would be symmetrical with respect to the axis of the screw, would be sufficient to drive the nut upon the screw. As this movement was found to be too slow, a guiding rod was used.

The grinding process was continued for three weeks, and the results obtained confirmed previous experience. At the end of the first week the maximum error of $\frac{1}{5000}$ of an inch had been reduced about one-half, but it was found that small errors had been introduced in the mean time at other points, through a slight transfer of the errors of the screw to the nut itself and from thence back to the screw. Near the end of the second week the screw was clearly less perfect as a whole than at the commencement of the operation of grinding. Mr. Ballou then recut the nut, making its diameter a little less than that of the screw. Within a few hours thereafter a decided improvement was observed. A new nut was made at the end of the second week having its diameter still a little less than before. During the third week the gain consisted for the most part in eliminating the errors which had been introduced during the second week. Throughout the entire operation of grinding, reversals were made every hour both of the halves of the nut and of the screw upon its centers.

In the discussion Oberlin Smith said he understood that one of the troubles in the screw problem was deflection. He asked if the screw had been tried mounted in a vertical position.

Prof. Rogers replied that in other instances screws had been tried in this position, but not in this instance. Screws of precision were not generally used standing vertically.

Mr. Towne said that they had made the effort to cut two short screws that should be exactly alike in pitch, the screws being required for a special purpose, but although they used a lathe provided with what was considered a very accurate lead screw, having been specially made, they did not succeed. He considered this as a case occurring in ordinary machine practice, and as showing the practical advantage of greater accuracy.

Prof. Sweet argued that having obtained a practically perfect screw there remained the difficulty of using it so that it should remain perfect. In using a comparatively short nut on a long screw, the screw under the ordinary conditions of use was unequally worn at different places in its length, the result being that the originally accurate screw soon became full of inaccuracies. Were it possible to use a nut of a length equal to that of the screw the accuracy of the latter might be maintained. Imagine a long and nearly accurate straight edge, but with small local inaccuracies along its length, and then trying to remove these inaccuracies by grinding with a short and perfectly accurate straight edge, and you have a fair idea of the conditions existing in the use of a short nut on a long screw. The accurate straight edge must be as long as the one it is used to correct. He had often thought that, in the lead screw of a lathe for instance, by removing some of the threads on the parts of the screw that were used the least the tendency would be to a better preservation of the accuracy of the screw, but as in many other things he had never had the courage of his convictions in a sufficient degree to do what he thought was right.

Prof. Webb suggested that arrangements might be made to connect the nut to the screw at any desired position in its length, and then a record kept of the time that different parts of the screw were used, and by this means the wear of the screw over its entire length could be practically equalized.

Mr. Kent placed a sketch on the blackboard, illustrating the use of connecting links of different lengths to accomplish the purpose named by Prof. Webb.

Mr. Reese was astonished that the question of molecular physics had not received attention in the construction of a perfect screw. The molecular construction of steel was never uniform, and hence changes that would be constantly going on in the steel of which the screw was made would not be alike at different parts of its length. This he claimed would in time impair the accuracy of the screw, however accurate it might be made.

Prof. Rogers did not believe in this theory of molecular changes. He had seen no evidence of changes of the kind mentioned so far as they were related to impairing the accuracy of standards.

Mr. Porter believed that in the process of grinding, the grinding material became imbedded in the metal, and that in using the screw the grinding went on. He suggested that the corrections be made by scraping rather than by grinding.

It was suggested by other speakers that in the case of a screw the surfaces were of such shape that scraping was impracticable.

RULES FOR CONDUCTING BOILER TESTS.

By William Kent.

Mr. Kent began with the statement that the object of his paper was to open a discussion that should lead to the adoption of rules for conducting boiler tests that would be generally adopted by engineers, so there would be uniformity of practice, instead of the confusion that now prevails. After dwelling upon the importance of having the conditions thoroughly known, he continued as follows with reference to matters during the test:

1. *Keep the conditions uniform.*—The boiler should be run continuously, without stopping for meal times or for rise of pressure of steam due to increased demand for steam. The draught being adjusted by means of the damper to the rate of coal combustion desired before the test is begun, it should not be changed during the test.

If the boiler is not connected to the same steam pipe with other boilers, an extra outlet for steam should be provided, in case the pressure should rise to that at which the

safety valve is set; and in case of such rise of pressure it should be reduced to the desired point by opening the extra outlet, without checking the fires.

If the boiler is connected to a main steam pipe with other boilers, the safety valve on the boiler being tested should be set a few pounds higher than those of the other boilers, so that in case of a rise in pressure the other boilers may blow off, and the pressure be reduced by closing their dampers, allowing the damper of the boiler being tested to remain open, and firing as usual.

All the conditions should be kept as nearly uniform as possible, such as force of draught, pressure of steam, and height of water. The time of cleaning the fires will depend upon the character of the fuel, the rapidity of combustion, and the kind of grates. When very good coal is used, and the combustion is not too rapid, a ten-hour test may be run without any cleaning of the grates, other than just before the beginning and just before the end of the test. But in case the grates have to be cleaned during the test, the intervals between one cleaning and another should be uniform.

2. *Keeping the records.*—The coal should be weighed and delivered to the firemen in equal portions, each sufficient for about one hour's run, and a fresh portion should not be delivered until the previous one has all been fired. The time required to consume each portion should be noted, the time being recorded at the instant of firing the first of each new portion. At the same time the amount of water fed into the boiler should be accurately noted and recorded, including the height of the water in the boiler, and the average temperature of feed and pressure of steam during the time. By thus recording the amount of water evaporated by successive portions of coal, the record of the test may be divided into several divisions, if desired, at the end of the test, to discover the degrees of uniformity of combustion, evaporation, and economy, at different stages of the test.

When the pressure of steam and temperature of feed are nearly constant, half-hourly observations of each will be sufficient; but when there is considerable variation, observations should be made more frequently, and the figures recorded should be the averages for each interval of time rather than the figures which are observed at the end of the interval.

3. *Priming tests.*—In all tests in which accuracy of results is important, calorimeter tests should be made of the percentage of moisture in the steam, or of the degree of superheating. At least ten such tests should be made during the trial of the boiler, and the final records of the boiler test corrected according to the average results of the calorimeter tests.

On account of the difficulty of securing accuracy in these tests, the greatest care should be taken in the measurements of weights and temperatures. The thermometers should be accurate to within a tenth of a degree; the scales on which the condensed steam is weighed to within one hundredth of a pound.

REPORTING THE TEST.

The final results should be recorded upon a properly-prepared blank, and should contain the following items:

1. Heating surface	....	sq. ft.
2. Grate surface (ft. in. long × ft. in. wide)	....	sq. ft.
3. Ratio of heating to grate surface	....	
4. Kind of fuel used	....	
5. Duration of test	....	
6. Average steam pressure	....	lbs.
7. Average temperature of feed	....	deg.
8. Pounds of coal burned	....	lbs.
9. Pounds of refuse	....	lbs.
10. Pounds of combustible	....	lbs.
11. Per cent. of refuse	....	per cent.
12. Coal burned per sq. ft. grate per hour	....	lbs.
13. Total water evaporated	....	lbs.
14. Water evaporated per hour	....	lbs.
15. Water evaporated per sq. ft. heating surface per hour	....	lbs.
16. Water evaporated per lb. Coal—Actual conditions	....	lbs.
17. Water evaporated per lb. Combustible — Actual conditions	....	lbs.
18. Water evaporated per lb. Coal—From and at 212°	....	lbs.
19. Water evaporated per lb. Combustible from and at 212°	....	lbs.
20. Quality of steam. (Moisture or superheating)	....	
21. Rated horse-power. (Builder's rating)	....	H. P.
22. Horse-power developed at 30 lbs. of water evaporated per hour from and at 212°	...	H. P.
23. Per cent. above (or below) rated capacity	....	per cent.
24. Temperature of boiler room	....	deg.
25. Temperature of flue gases	....	deg.
26. Force of draft in inches of water	....	inches.

In discussing this paper, Mr. Le Van objected to a steam pressure of 70 pounds being used, as the practice at present was to carry higher pressure. He thought all comparisons should be as nearly as practicable in terms of actual practice.

Mr. Pratt, in a communication which was read by Secretary Hutton, suggested that in the instance of a boiler to be tested, say under 75 pounds pressure, that steam be raised to 100 pounds, then blow down to 75 pounds and call time. Haul fire and weigh quenched coal at the conclusion of test. If the fire is, say 4″, then add 50 per cent. to that weighed back, and you have an allowance for a 6″ fire.

Mr. Emery thought the rules quite good, but perhaps lacking in detail. It was a common method to haul fires, and to weigh back at conclusion of test. In this case the time should be noted when the boiler begins to make steam, and not when the fire for the run is started. He considered estimating the condition of fires at stopping and starting a better plan than hauling fires and weighing back. There was always a liability of error in the latter plan. Boiler tests were seldom made with thoroughness. In making such tests assistants should be placed at all points of observation. One man *could* observe conditions at a good many points, but his observations could hardly be considered reliable.

It was often found difficult to do what is apparently so simple a thing as to keep tally correctly. Often it was a serious question with the one keeping the tally of coal or water, whether or not the last quantity of coal delivered, or the last tank of water filled, had been tallied. This can be avoided by fixing some point to note from, as when the coal is dumped on the floor, or the water cock opened. Measured water could be fed from one tank, but three, one a settling tank, should be used. Uniformity in supplying both coal and water should be observed. Barrel calorimeter tests were quite generally condemned, but their condemnation is owing to mistakes in making them. Steam is frequently superheated in the small pipe where it leaves the large one. The arrangement should be such that the steam would enter the small pipe at full pressure.

Mr. Le Van thought that increasing the pressure so much beyond that at which the boiler was to be tested would not generally be permissible, as boilers are tested and allowed a pressure at which they were to be run, or at which the safety valves were set. He did not believe in the guesswork involved in estimating the coal on the grate. Coal should be weighed for an hour, and that not used weighed back, thus affording means of hourly comparisons.

Mr. Woodbury had been connected with a number of boiler tests, and had devised a graphical method of showing results which he had found very satisfactory. He illustrated this method on the blackboard. It consisted in setting off on a sheet vertical divisions, each representing a certain quantity of fuel, and horizontal divisions representing time, and then as the fuel was supplied plotting a curve representing the fuel consumption during the test. From the beginning the curve would generally rise too rapidly, and toward the close too slowly, but intermediate it would be regular, and nearly a straight line. This portion of the curve was the one from which the duty was calculated, omitting the irregular portions near the beginning and end.

Mr. Nagle thought the water supplied to the boiler under test, as well as the coal, should be plotted.

Mr. Porter said that, notwithstanding the plotting, there still remained an assumption. The amount of coal on the grate might be gradually increased from the beginning to the end of the test, which the line plotted would afford no means of determining. He thought a test should be begun with a clean grate.

Mr. Leavitt believed that in conducting a boiler test it should be assumed that every one around would steal coal and cheat otherwise, and hence the means of making observations should be complete. He agreed with Mr. Porter that the test should begin with a clean grate, and weigh back coal unconsumed.

Mr. Kent explained that by cleaning fires he referred to pushing the coal to the back end of the grate, and then spreading it out over the grate, by which means the amount of coal could be estimated twice. As the amount of coal present at these times was small, no serious error would be probable.

Other speakers who discussed the subject did not believe that an allowance of 30 lbs. of water evaporated per hour from and at 212°, as advocated in the paper, was a sufficient allowance per horse-power.

At the conclusion of the discussion on this paper, on motion of Mr. Kent, provision was made for the appointment of a committee on boiler tests, to report at a future meeting.

NEW YORK TO CHICAGO IN SEVENTEEN HOURS.

BY W. BARNET LE VAN.

In discussing this paper, a summary of which we gave last week, Mr. Emery said the large cylinders of a locomotive were useful only in starting the train, but with the train in rapid motion the cut-off effected by the link motion, which in effect reduced the size of admission ports, was a benefit rather than otherwise. The large cylinders were not needed then, and with large ports and sharp cut-off the expansion would be too low for good economy, so that under the circumstances the wire-drawing incident to the use of the link resulted in saving steam. He referred to locomotives in which the ports had been reduced in length beyond the ordinary practice. Wheelock had tried a cut-off valve without satisfactory results.

Mr. Leavitt could not do better than to refer to Holley's remarks on the Corliss "Jigger." In this case the gain was not equal to the trouble and expense of keeping the parts together.

Mr. LeVan said that at the time Holley's criticisms of the locomotive built by George H. Corliss were correct. But who at the present time would object to a Leavitt compound pumping engine, or a Worthington duplex pump? No one objected to the use of a Porter-Allen, a Buckeye, or a Corliss engine on account of the number of their parts or the additional care necessary to keep them up to their standard performance. All these machines were at first objected to on account of complex arrangement, but they have for years worked economically, satisfactorily, and without giving trouble. The satisfactory running, and the economy in the use of fuel, of the Corliss locomotive had never been questioned. Mr. Emery argues that the use of a separate cut-off valve, bringing about a sharp cut-off, would be the reverse of economical unless smaller cylinders could be used, and that this was not practicable because the large cylinders were required in starting the train. He forgets that my proposition is not to dispense with the link, but to retain the link and add a variable cut-off. I consider the link the readiest and simplest means of reversing the engine. Mr. Emery refers to instances in which the ports of locomotives have been reduced beyond the ordinary practice; so far as I am able to learn the results of such reduction in the length of ports has been the reverse of satisfactory.

A DRAWING OFFICE SYSTEM.

BY HENRY R. TOWNE.

In this paper uniformity in size of drawings was argued to be of importance. In most cases standard drawings could be restricted to two or three sizes. The title should be placed in the same position on each sheet, and was best located near the bottom. The use of sketch books for orders to the shops was recommended for all minor and temporary matters. For this purpose a sheet measuring about 9x12 inches was recommended, which should be cross-ruled into squares of one-quarter inch each way, thus facilitating the practice of sketching accurately to scale. The sketch sheet should be of quite stiff paper, with blanks for the insertion of the order number, date, name of draftsman, etc. All sketches on these sheets should be made in copying ink, numbered consecutively, and as soon as finished they should be press-copied in an ordinary letter-book. Templates or full-size drawings should always be prepared in the drawing-room, as the chances of error are thereby lessened. All lists of bolts, timber, or materials of any kind, should be prepared in and issued from the drawing office, a record being kept by means of the letter-press process. Pencil sketch books should be provided for every draftsman, who should be instructed that *all* his preliminary sketches, calculations, and notes of all kind, should be made in these books, and not on loose sheets. No effort should be made at nicety, and under no circumstances should original work be done on loose sheets and then transcribed into these books. Their purpose was to serve as *original* records.

The material of which each part shown by the drawing is to be constructed shall be indicated thereon by means of the following symbols, viz:

CI.—Cast Iron; GI.—Gun Iron; Bz.—Bronze; TS.—Tool Steel; SC.—Steel Casting; CRS.—Cold Rolled Steel; WP.—White Pine; Ok.—Oak; Ch.—Cherry; Wh.—Whitewood; WI.—Wrought Iron; Bs.—Brass; MS.—Machinery Steel; BS.—Bessemer Steel; SMS.—Siemens-Martin Steel; SP.—Spruce Wood; YP.—Yellow Pine; As.—Ash; BW.—Black Walnut; My.—Mahogany.

Finish—The kind of finish required on each of the different parts shall be indicated on the drawing by means of the following symbols, viz:

D.=Dressed or Tooled, and indicates that the surface to which it applies is to be dressed off in whatever manner its nature or shape best admits of.

F.=Fine Finish, and indicates that, after planing or turning, the surface is to be further finished by file or emery.

P.=Polished, and indicates polishing by means of emery wheels or a similar process.

S.=Scraped, and indicates scraping down by hand.

G. F.=Grinding Finish, and indicates that the only finish to be allowed is that necessary for grinding.

G.=Gauge Dimension, and is to be *prefixed* to the measurement to which it applies. Thus, G. 2.75 in. indicates that in finishing the work this dimension is to be obtained by using the $2\frac{3}{4}$ in. standard gauge.

The Russian Government is pushing a railway through the sparsely inhabited region of Central Asia. In some portions of the line the expected traffic will be so light that arrangements have been made to use camels as motive power. A visitor to this office suggests that on this novel train the engineer should play the bag pipes, screaming the Argyle quickstep, to indicate to the natives that the camels are coming.

The Franklin Institute has issued a special notice having reference to quantitative tests of steam engines at the International Electrical Exhibition of 1884. From this we learn that exhibitors of engines who desire such tests made must make formal application before July 15. The notice referred to, which can be had by addressing the Franklin Institute, Philadelphia, gives complete conditions of exhibition and test of engines.

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NEW YORK, JUNE 14, 1884.

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How Not to Guarantee Machinery.

When business is dull, methods of selling become specially important. It has not escaped the observation of many persons familiar with the machinery trade, that a good many machinery establishments, in offering their products to the public, are backing up on the standard of quality reached by older shops, rather more than is good for themselves or for the trade.

Recently an instance came to our knowledge, in which the builder, or rather manufacturer, of certain machinery was asked by an important customer, if he would guarantee his machines to be as good as those made by a certain large establishment. The very creditable reply was "No, but I will guarantee they shall be well built, and do your work to your entire satisfaction." He got the order, and deserved to get it. The point of his reply was not blunted by the fact, that his price for the corresponding machine was considerably less than that of the older establishment. Had the younger manufacturer been content to accept as his only present or future standard the work of another shop, however favorably known its work might be, he would have confessed himself as striving to occupy no higher position than that of an imitator, compelled to work without profit.

Manufacturers of machinery frequently choose, of their own accord, to place themselves in the position which the establishment previously mentioned refused to occupy even while answering the question of a prospective purchaser. To say voluntarily, as the prime argument, that one's new tool or machine is as good as Smith, Jones and Robinson's tool or machine of that size, or a larger size, or better than their tool or machine of any size, at once transfers the attention of the purchaser from its positive, to its comparative, merits, and such a transfer always involves peril. It unnecessarily sets up a standard, which, unless the comparison is accepted as based upon mere talk, involves delay and examination of the rival establishment's product. This becomes specially evident, when it is considered, that a purchaser who is willing to rely upon the maker's unsupported assertion, that his tool or machine is equal to or better than that made by some other establishment, would be just as likely to rely upon his candid summary of its own positive merits, considered wholly on its merits. Manufacturers of machinery, who, in talking to purchasers, or making up their descriptive circulars, allow themselves to fall into the habit (for it is often only a habit, and not at all a matter of necessity) of trying to pull themselves up by hanging on the coat tails of this or that prominent manufacturer, would do well to ask themselves whether real reputation is to be made in that way.

Looked at from another point of view, this practice is bad for the trade. Of course the prominent establishments whose competitors are content to advertise them in this fashion, receive a certain sort of benefit and a good deal of it. But, inasmuch as machinery so offered must of necessity be regarded by users as in one way or another inferior, because sold on the merits of somebody else's work, it is sure to be sold at a lower price, and this is liable to mean lower quality. The firms whose work is thus made the standard of quality, find themselves competing against lower prices on the same alleged basis of quality, and are under perpetual temptation to lower that standard. This sort of competition is bad for all concerned, and presents only another illustration of the homely truth contained in the old adage, that it is better to "let every tub stand on its own bottom."

Mr. W. J. Smith, master mechanic of the Central Pacific Railroad at Carlin, Nevada, came all the way from the Pacific Coast to attend the meeting of the Society of Mechanical Engineers at Pittsburgh. We have to acknowledge a pleasant visit with Mr. Smith at this office. Carlin is a railroad town in the midst of a barren wilderness, and Mr. Smith confessed himself glad to get back for a few weeks into the haunts of civilized man.

In the discussion of Prof. Rogers' paper at Pittsburgh, Mr. Porter's suggestion to correct the errors of the screw by scraping rather than by grinding is worth some thought. Those who have ever experimented in grinding slide valves to their seats, know the result when the engine is put to use. The surface of a screw thread is not a convenient surface to scrape, but it is by no means impossible to fit it in that way; in fact if it was determined that it should be fitted by scraping, means for doing it without serious trouble would be likely to suggest themselves.

Mr. Emery's remarks, in the discussion of Mr. Le Van's paper, on the time when the large cylinders of the locomotive are required, and his argument based upon this that the disadvantages of the link motion are more fancied than real, may be profitably considered by those who are anxious for some kind of lightning cut-off on the locomotive.

A prominent member of the society said that one of the most noteworthy things he saw at Pittsburgh was the constant employment of two men in the tool steel department of the Crescent Steel Works to find fault with what had been done. The duty of these men is to detect imperfect bars in the product, that is imperfections in the finished bars of so slight a nature that they would escape the eye of any but an expert.

Mr. Leavitt's allusion to stealing in connection with boiler tests, in the discussion of Mr. Kent's paper, should be taken figuratively rather than literally. He undoubtedly referred more to the necessity of extreme care in making such tests than to the total depravity of engineers and firemen in general.

Prof. Sweet's query of how to keep a screw perfect in use (after having made it perfect) is one of the puzzling questions that will immortalize the man who answers it.

The Triple Thermic Motor.

For the last year frequent allusions have been made to the motor with the above pretentious name, in the technical press, and in some quarters reporters for daily papers have industriously advertised the motor as one of the greatest discoveries of the age. As usual when anything reputed as a valuable mechanical appliance has been announced, we have received numerous letters asking our opinion of the triple thermic motor. To try and satisfy these inquirers, and to enlighten our readers about this invention, we made repeated visits to the works of the Russell Pavement Company, East Forty-sixth Street, in this city, where the motor is at work, in hopes that we would be permitted to examine the machine. We were well received by Mr. Colwell, the inventor, who proved a magnificent talker on his favorite topic—bisulphide of carbon, or his motor operated by the vapor of that compound. Mr. Colwell did not appear to entertain cordial sentiments towards technical papers, but he was pleasant to the representative of the AMERICAN MACHINIST, and at various times promised to let him see the motor at work when he got ready, but that time has not come round yet. The request was made that the proprietors of the triple thermic motor should permit us to apply an indicator and a friction brake to the motor, but this proposal met with a firm refusal. This proposal was made to Mr. Colwell just as he concluded an eloquent tribute to the mechanical value of the machine, and we urged that, since the device was so perfect, such a public investigation would improve its standing before the mechanical world. Mr. Colwell replied that the company had nothing to do with the public. They were not asking anything from the public, and they did not invite the public to pry into their affairs. "Do you," he said, "invite the public to come into your office to see how the editorial work of the AMERICAN MACHINIST is done?" We suggested that the cases were not exactly parallel, yet we permitted the public to see every week what had been done in the editorial rooms, when they could judge the work for themselves. We wanted to put them in exactly a similar position in regard to the triple thermic motor. We could not, however, succeed in making Mr. Colwell regard the case from our standpoint.

A letter and newspaper which we recently received from Lowell, Mass., convince us that the public of that town, at least, are more interested in an investigation of the triple thermic motor's operation by disinterested parties than Mr. Colwell was willing to admit. The paper gave the account of a public meeting called for the purpose of organizing a company with $25,000,000 capital, to promote the interests of the triple thermic motor. The leading speaker was Dr. Colwell, a clergyman of Lowell, and brother of the motor's inventor. According to the printed report Dr. Colwell used more than ordinary eloquence to float the motor company scheme, and a private correspondent informs us that strong influences are actively enlisted in the motor cause.

There has been nothing shown by the promoters of the triple thermic motor scheme to indicate that the method of applying power that they are building a fat joint stock company upon, is a whit better than many other schemes that have brought financial ruin to hundreds of people. The bare word of parties interested in making money out of the motor is all the assurance given the people asked to subscribe to the stock of the company that the thing is not worthless. Some years ago a bisulphide of carbon engine was brought out by the same parties, and it did not prove a success. There is certainly no guarantee that the triple thermic motor will prove better than its prototype.

A Word About Asking Questions.

We frequently receive letters asking questions relating to mechanical points, which are prefaced with the explanatory remark: "I am not a mail subscriber, but take the paper regularly from my newsdealer;" or, "I venture to ask a question, this being the first time I have troubled you," etc.

Now, there is a misapprehension in these cases which we wish to correct. Our "Questions and Answers" department is intended for the benefit of our readers generally, and it does not matter to us whether a question is the first or the fiftieth from the same inquirer, if it relates to a mechanical point the published solution of which is of interest to the general mechanical public.

Nor does it matter whether the inquirer gets his paper direct from us by mail, or buys it each week from his newsdealer.

It goes without saying that an individual who never reads the paper will not be likely to ask questions to be answered through it.

Reported Discovery of Tin.

The Government Geologist for Montana has reported the discovery of large quantities of tin ore in the Black Hills region. The ore is said to be cassiterite, the most valuable tin ore known. The reports given look sensational, it being asserted that a high mountain peak is a complete mass of this ore. Cassiterite is generally found in regular fissure veins in the primary rocks, this being the only mineral ore that seems to find a congenial home between vein walls of granite. Should the discovery prove, after careful investigation, half as valuable as the reports make it out, it will revolutionize the tin trade.

Literary Notes.

Descriptive America is the title of "A Geographical and Industrial Monthly Magazine," the initial (May) number of which has been issued in attractive form by Geo. H. Adams & Son, New York. We note the omission of their street and number, which is 59 Beekman Street. The magazine is a large one, having illuminated colored covers, and bear-

ing as its salient feature a handsomely engraved and colored map of Colorado in the front, showing railroad and county lines, location of mountains, streams, and towns, in a shape that will be found useful. As we understand the plan of the new publication, it is proposed to make some one State or territory of the United States the leading feature of each number. A large amount of pictorial, statistical, geographical, and other information regarding the State in question accompanies the map, though we do not understand that other subjects pertaining to the general scope of the work are to be rigidly excluded. We think its scope might be somewhat enlarged without doing violence to its title, so as to include, from time to time, for the benefit of "Descriptive Americans," small maps of other countries as geographical and political changes occur. But Messrs. Adams & Son are probably better qualified than most persons to judge whether such enlargement would be attractive to those whose favor they seek. We bespeak for the new magazine the attention of the reading and business public, and believe it destined to occupy a wide and useful field. We are informed that the June number will relate especially to Dakota, and the July number to Michigan. The subscription price is $4 a year. Single copies, 50 cents.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(231) G. M., Ashtabula, O., asks: What is chrome steel, and for what is it used? *A.*—Chrome steel is steel to which a small percentage of chromium has been added. When it is added to cast steel it is used for tools, and other purposes.

(232) H. H., New York, asks: 1. If I wish to procure a patent how can I find if the device has already been patented? *A.*—The best plan is to get a patent attorney of recognized ability and honesty to make a preliminary examination, which will cost you five dollars. In case this examination reveals nothing in the way, and you go on to secure a patent, the five dollars will apply on the attorney's fees.

(234) N. S., Hartford, Conn., asks: 1. Why will a leather belt transmit more power and wear longer with the finished side next the pulley? *A.*—The reasons usually given for running the hair side next the pulley are, that being smoother than the other side the contact with the pulley is better, and that the strongest fibres being nearest the flesh side they should be preserved as long as it is possible to do so. 2. Does the friction of a belt vary with the width? *A.*—For all practical purposes, in working, it does.

(235) G. H., New York, asks: What should be the size of safety valve for a stationary tubular boiler 54″ diameter, 12 feet long; 68 tubes, 3″ diameter; steam pressure 90 lbs.; and, is there a rule for the size of safety valves? *A.*—There is no established rule for determining the dimensions of safety valves. Various authors give rules differing one from the other, and none being universally applicable. A safety valve should be proportioned to the amount of water to be evaporated, and the pressure of steam. We should say that for a boiler, such as described, a common lever safety valve should be 4″ diameter.

(236) C. W., Paterson, N. J., asks: How can I galvanize cast iron? *A.*—Cast iron can be covered with zinc by the following method: First, thoroughly clean the pieces to be coated, then heat moderately hot, and plunge them in hydrochloric acid in which as much zinc in small strips has been placed as the acid will take up. In this liquid, after the addition of the zinc, about one-tenth, by weight, of sulphate of ammonia should be dissolved. The castings should be dipped in this liquid and quickly removed, and should have been heated sufficiently so that they will instantly dry. As soon as dry, and while yet hot, plunge them in a bath of melted zinc, with a little salammoniac sprinkled over the top.

(237) S. B., Haverhill, Mass., says: Suppose an eccentric on a locomotive should slip when running, can it be set again without removing the steam chest; and, if so, how? *A.*—When an eccentric slips on the road, the easiest way to get it back to its place is by a measurement taken from the other eccentric's position. If, for instance, the forward eccentric slips, the engine is placed with the crank-pin on that side on the dead center. The reverse lever is then put in the full back notch and a scratch made on the valve stem close to the gland. The lever is now put in full gear forward, and the slipped eccentric turned till the scratch on the valve stem appears in the same position it occupied when the lever was in the back notch. Care must be taken to see that the slipped eccentric is not set in the same position as the backward eccentric. A careful study of Angus Sinclair's recent articles on Locomotive Engine Running would give full information on this subject.

(238) H. A. S., Charlotte, Me., asks: 1. Can you see any danger in making a grate of water tubes for heating water for domestic purposes, provided an automatic feed keeps the tubes full of water, and the steam pipe is kept open? *A.*—There is no danger if you provide means for relieving the pressure before it reaches a dangerous limit; such, for instance, as a reliable safety valve. 2 Would there be any danger with such an arrangement if, when water is required for laundry purposes, water under a head of fifty feet were allowed to run through it? *A.*—Not if the arrangement of pipes is such that suddenly cooling them does not cause them to leak, or by contraction to break some of the parts. At the same time we do not see why an ordinary water back range or stove, such as sold by all dealers, is not better. 3. Do you consider sectional boilers, such as made and sold, less desirable than other forms? *A.*—One of the advantages of sectional boilers is in the fact that they are not liable to disastrous explosions.

(239) J. R., Detroit, Mich., asks: 1. How do you find the area of an indicator diagram? *A.*—The area is generally found by the use of the planimeter. It can, however, be found by averaging the height and multiplying the average height by the length. 2. What is the advantage of having the wheels of a car loose on the axle, and the axle loose in journals; and, in running such a car, would the wheels revolve on the axle or would the axle revolve in its bearings? *A.*—One loose wheel is sometimes used to prevent slipping in going around curves. If both wheels are loose they will be likely to revolve around the axle. 3. Can a horse move a load easier on large than on small wheels? *A.*—Yes The principal reason is that obstacles are easier passed over by large than by small wheels, as you will readily see if you study the matter a little. 4. How is cast iron converted into malleable iron? *A.*—See AMERICAN MACHINIST of August 4, 1883. 5 In an old-fashioned oil cup, on a steam chest, sometimes the oil will remain in the cup all day, when the engine is running, but will all run out as soon as the engine is stopped. The oil being heavier than steam, why will it not run out when the engine is running? *A.*—It is not a question of weight, but of pressure. The pressure of steam in the steam chest holds the oil in the cup.

BUSINESS SPECIALS

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Mackenzie Cupolas and Blowers, 245 Broadway, N.Y.

Springs—List free. T. F. Welch, 11 Hawkins st. Boston.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass

Interchangeable work a specialty. Send stamp for new Lathe Catalogue. E. O. Chase, Newark, N. J.

For first-class machine patterns and estimates, address John Valentine, 15 Alling st., Newark, N. J.

INVENTIONS perfected, designed, or patented. E. P. Robbins, M. E., Cincinnati, O.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Fine tools and special machinery. Horace Thurston, 84 Clifford street, Providence, R. I.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 84 Market st., Chicago, Ill

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

National and box chucks, foot and power lathes, and slide rests. Lodge, Barker & Co., Cincinnati, O.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

Split Pulleys at low prices, and of same strength and Appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Difficult machines invented and built; coarse screws cut. V rotary files for fine milling, by mail 50 cts. Tower Machine Works, E. Brookfield, Mass.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

I have a well-equipped machine shop and foundry, and would be pleased to give estimates for building any kind of machinery. H. W. Bullard, Poughkeepsie, N. Y.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

MANUFACTURES.

W. McCormack & Son, of Dundas, Ontario, are starting a carding mill at that place.

A silk mill is to be erected on Mr. Wilson's property, on Marshall street, Paterson, N. J.

The Green Mountain Pulp Company, Green Mountain, Vt., is building a mill at Weybridge.

The Union Metallic Cartridge Company, of Bridgeport, Conn., is now running on four days' time.

The towns of Sweetwater and Victoria, Tex., are to have water works soon.—*Dallas Machine Journal.*

Bangor and Ellsworth, Me, parties are about to start up the Ellsworth Foundry and Machine Shop.

Schniedewend & Lee are to erect a five-story factory, at 46 and 48 Third avenue, Chicago, to cost $20,000.

Jerry Johnson, Louis Emmitt, and others, at Fayetteville, N. C., have organized a foundry and machine-shop firm

Simon Strauss, 179 Lewis street, New York City, has ordered two new boilers for a new factory that he is about to build.

The McCormick Harvesting Machine Company, of Chicago, employ 1,600 men on full time, and report prospects better than last year.

Landers, Frary & Clark, of New Britain, Conn, will not build a new factory, but simply add a small addition to their present factory.

Forbes & Curtis, Bridgeport, Conn., report business good, but collections slow, especially in the West. Eastern collections very fair.

The employes of the Jersey Central shops, at Phillipsburg, Odenwerder, Hampton, and Elizabethport, N. J., are only working two days a week.

Simon Strauss, 720 Fifth avenue, New York City, is erecting a six story brick factory building, 72 feet front, at 179 to 183 Lewis street, to cost $35,000.

Kearney & Foot expect to occupy the new file works, which they are erecting at Riverside, a suburb of Paterson, N. J., about the first of August.

Harvey K. Flagler, and others, are starting a new tube works in Boston. Capital, stated to be $450,000; a result, as we suppose, of the tube combination.

The Crosby Steam Gage and Valve Company, of Boston, have opened a branch office at 21 Cross street, Finsbury, London, E. C., for the British trade

According to the *Railway Age*, the Cleveland, Delphos, and St. Louis Railroad is to be changed to the standard gauge and extended to Akron, O. The shops will probably be located at Delphos, O.

Somers Brothers, Front and Pearl streets, Brooklyn, N. Y, are erecting, at corner of Third avenue and Third street, that city, a four-story brick engine-house and factory, latter being 158 and 58 by 205 feet, to cost $60,000.

A wire rope, over six miles long and one and a fourth inches thick, is being manufactured at the Hazard Works, of Wilkesbarre, for the Third-avenue passenger railway, in New York City, under the traction system.

The construction of water works to cost $70,000 is proposed at Prescott, Arizona. In the Weaver mining district of Arizona a system of hydraulic works, involving an outlay of half a million dollars, is also talked of.

The Fall Mountain Paper Company, at Bellows Falls, Vt., is to build a large brick mill on the site of the company's wood-working building known as "No. 1." The company has already twelve mills.—*Paper Trade Journal.*

Charles H. Phinizy, Stewart Phinizy, Jacob Phinizy, and J. J. Cohen, all of Augusta, Ga., have organized a cotton manufacturing Company, to be known as the Algerlon Mill. Capital $100,000.—*Baltimore Manufacturers' Record.*

The manufacture of a new mower will soon be commenced at Jackson, Mich., on a large scale. Its distinctive merit is that such a motion is given to the knife-bar that the sections strike the grass in the same manner as a scythe in mowing.

The business men of Seymour, Ind., have organized a merchants and manufacturers' club, the object being to encourage the erection of manufactories and other enterprises calculated to enhance the growth and prosperity of the city.

Williams & Savage, of Buffalo, N. Y., have the contract for building the new Post sewing-machine shops in Batavia. The building is to be 300 feet in length, and will cost from $20,000 to $25,000. The business is to be in operation early in the fall.

Sir Titus Salt, Mr. Charles Stead, of Saltair, England, and William Donaldson, of Glasgow, Scotland, have decided to erect two blast furnaces on their mineral lands, at Dayton, Tenn., near Chattanooga. Capacity 250 tons a day. They will spend over $500,000.

Clem & Morse, of Philadelphia, have had some recent trials of their improved pneumatic safety catch on an elevator. When the rope was cut, the elevator fell 1¾″ with scarcely a shock. When ascending, to make another trial, the rope broke unexpectedly, the catch working again to a charm.

James Aitchison, Cleveland, O., recently shipped two special machines to St. Louis, for cutting off ¼″ gas pipe for gasoline stoves. Capacity of each machine is from twelve to twenty pieces a minute. It uses three knives that are fed in automatically. The knives revolve, and the pipe remains stationary.

A company has been formed in Boston to introduce electric motors, for running all kinds of machinery, in New England, under the patents of Leo Daft. Among the directors is Charles Whittier, of the Whittier Machine Company, Boston. The company's circular is said to be the first piece of printing done by electric power in the country.

The Weston Engine Company, Painted Post, N. Y., write us: Our shops, burned to the ground on the 27th of February last, have been rebuilt, with better facilities, and are now running with orders for eight or nine months ahead. Our new automatic engine is giving every indication of being a decided success. Owing to the fire, we have fallen behind on orders for them.

Colorado City, Tex., a new and enterprising town on the Rio Grande division of the Texas and Pacific Railroad, has closed a contract with the Holly Manufacturing Company, of New York, for the construction of water works, to be completed within six months. This town, which now has a population of about six thousand, three years ago had no existence.

We learn from the *Buckeye Vidette*, of Salem, O., that J. W. Thompson, master workman at Buckeye Engine Shops and inventor of the Thompson steam engine indicator, has designed a superior, quick-running 5″x10″ engine, which the company has built, and set to running their electric lights. It is capable of making 350 to 450 revolutions per minute. It has the automatic Thompson fly-wheel governor, and "runs like a top."

The Watts, Campbell Company—Corliss engine builders, Newark, N. J.—have just opened a branch office at corner Fifth and Chestnut streets, Philadelphia. Frank E. Campbell, son of the president of the company is manager. The company has just received an order for a 400-horse power compound engine, from the Highland Worsted Mills, Camden, N. J.; also a 28″ by 48″ condensing engine from the California Cotton Mills Company, Oakland, Cal.

A. M. Powell & Co., Worcester, Mass., are building a special key-seat milling machine for McMurray & Stoughton, of Hartford, Conn. They have brought out a 30″ boring lathe, and will soon have one of 32″. They are building a new 24″ planer, and are getting out patterns for 26″ and 28″ planers. Their line of planers will then be complete, from 22″ to 42″. This firm has supplied the tools for the Stiles & Parker Press Company's branch shop in New York.

Joseph B. Reed, Cairo, Ill., writes us: We find trade some better than it has been, and for past three months have been quite busy. Our shipments since the first of May are as follows: Angelica Foundry and Machine Company, Angelica, N. Y., one 26 in. by 12½ ft. screw-cutting engine lathe; one 25 in. by 12½ ft. screw-cutting engine lathe to Springfield, Mo.; one each, 16 in. by 6 ft. 7 in., 12 in. by 8 ft., 10 in. by 12 ft., 25 in. by 12½ ft., 26 in. by 12½ ft. screw-cutting engine lathe, to L. M. Rumsey Manufacturing Company, St Louis, Mo.

Lodge, Barker & Co., Cincinnati, O., have now caught up with their orders, and can deliver their monitor turrets, square arbor, hand-speed and engine lathes on short notice, having some ready for shipment and others in course of construction, and ready for quick delivery. They are just putting on the market a new 24-inch shaper. They now have orders for five of these shapers, from parties who have seen them at work, and who were highly pleased with them.

J. A. Hill writes us some doleful news from South Pueblo, Col.: The Colorado Machinery Company, manufacturers of and dealers in all kinds of mining, milling, and smelting machinery—having works here, and warehouses here and in Denver—have failed. Liabilities about $100,000. This throws out of employment about fifty men, to whom the concern owes from $100 to $300 each, with little or no hopes of ever getting any of it. The Colorado Coal and Iron Company (main works located here) have shut down their steel rail mill. They are running their blast furnace full blast; puddle mill and nail mill five days per week. Times dull for mechanics.

The Betts Machine Company, Wilmington, Del., have just put in the foundation for a new erecting shop. It will be 122 feet long by 75 feet wide, with the center 25 feet high and the sides about 16 feet each. They are making it practically fire-proof, being composed of iron and brick, with very little wood work. The center of the building will be supported on wrought-iron columns, and these columns will also support the plate girders, on which one of the Morgan Engineering Company's twenty-ton traveling cranes will run. The shop will be well lighted and in every way suited to the erection of large tools. The traveling crane is of the latest and most improved construction, and will of course be driven by power. The Edge Moor Iron Company have the contract for the iron work and will deliver it next month. Should the weather prove favorable, the building will be under roof not later than the end of June. This addition to the already extensive works of the company will give them greatly-increased facilities for handling their constantly-growing business.

Machinists' Supplies and Iron.

NEW YORK, May 29, 1884.

The supply business maintains a quiet aspect, the late financial disturbances having tended to render buyers conservative.

Iron, pig, American—Business in this line is quiet, sales being mostly of a retail character. Most of buyers have contracted for their supplies for several months ahead. We quote No. 1 X Foundry, $20; No. 2 X $18.50 to $19; Grey Forge, $16.50 to $17.

Scotch—The demand continues slow and the market dull and irregular. Shotts, $21.50 to $21.75; Coltness, $21.50, to arrive; Glengarnock, $21 to arrive, $21.50 yard; Gartsherrie, $21.50 to $22; Eglinton, $19.50.

Antimony—Regulus rules quiet; we quote Hallett's, 10¼c.; Cookson's, 11c.

Copper—The demand for ingot continues light, and most of the sales are of a retail character. Lake, 14¼c.; other brands, 13¼c. to 13½c.

✻WANTED✻

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Mechanical engineer and draughtsman, with good references, wants engagement. Address Box 3, AM. MACHINIST.

A thoroughly educated mechanical engineer and draughtsman, with large experience in building and designing various machinery. Best references of leading firms. Address Box 7, AM. MACHINIST.

Wanted—Live Foreman, for a machine shop in Western Canada, on first-class engine and mill work. Apply, with terms, to "Tar," care of AM. MACHINIST, New York.

A student, who has nearly completed the course required in the Hoboken Institute of Technology, in addition to a course in civil engineering, would like employment in either branch. Address C. H. Lindenberger, Defiance, O.

Situation wanted, as foreman of a boiler shop. Have had 20 years' experience as foreman, and am conversant with marine stationary and locomotive work. Address George Marshall, care AMERICAN MACHINIST.

Wanted—A good, practical iron moulder to take half-interest in a small moulding shop. For a suitable man we have a first-class opening here. For further particulars write to Jesse Astall, West Strand Iron Works, 67 Strand, Galveston, Texas.

Experienced mechanical engineer is open to engagement. Good draughtsman. Has had charge of works. Specialty steam engineering in all its branches; expert with indicator; competent to design, handle men, or travel. Good record; best of references. Address Box 9, AM. MACHINIST.

Wanted—A first-class superintendent, to take charge of an architectural iron works, who understands plans, and is accurate in figuring quantities. Must be strictly temperate and have good recommendations. No others need apply. Address Wm. Bayley & Co., 340 Second avenue, Milwaukee, Wis.

Wanted—An experienced machinist, capable of taking charge of our vapor burner-making department, employing about thirty hands. Must be a first-class machinist (experienced in this business preferred) and tool maker, capable of making accurately small tools, taps, dies, etc., and keeping tools and product up to first-class standard. Must be thoroughly reliable, temperate, and capable of handling men, and the economical management of shop. Apply with references, stating character of work experienced in, salary required for a month's trial, and if satisfactory for permanent engagement, to Hull Vapor Stove Company, Cleveland, O.

A firm of engineers, having an established business and an extensive acquaintance among manufacturers, would like to open correspondence with some manufacturing concern, with a view of taking the agency for the New York market for some machinery specialties. Can furnish the best of references as to capability and responsibility. Address Room 123, Temple court, New York City.

FOR SALE OR RENT.

As we shall commence immediately the erection of new buildings, to meet the wants of our increasing business, we offer for sale or rent that part of the buildings owned and occupied by us as a foundry and machine shop. Foundry is 40 x 70 ft.; machine shop, 40 x 70 ft, two story. Warerooms, pattern rooms and office. These buildings will be vacated by us, Oct 1st, and are situated in the heart of the city of Canton, Ohio. The city contains over 21,000 inhabitants with four railroads and five banks. The shops are admirably situated for jobbing and for any kind of manufacturing for from 25 to 50 men. Cost of coal from 80 cts. to $2.00 per ton; and freight from the Mahoning Valley, Lake Superior Iron Furnaces, only one dollar per ton.

THE MILLER CO., Canton, Ohio.

MACHINE AND ENGINE SHOPS FOR SALE

At MT. VERNON, OHIO.

Machine, Foundry, Boiler, Blacksmith and Wood Shops, fitted with modern tools. All brick buildings and slate roofs. Fire-proof Pattern Warehouse. A first-class plant; capacity of 130 to 150 workmen. Now running and in good order. Railroad tracks, water-works and gas on the premises. For health, cheapness of coal or living there can be no better location.

Parties wishing to move from the East, or wishing to engage in this line of business, will find this a rare opportunity. Owners would retain one-third or half interest if desired, or large portion of the purchase money may remain on mortgage. N. WHITESIDES.

HILL, CLARKE & CO.

36 OLIVER STREET, Boston, Mass.

BRANCH OFFICE, 800 N. 2nd STREET, St. Louis Mo.

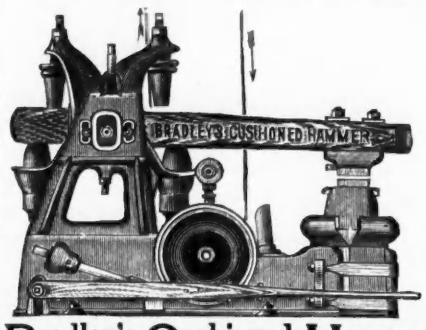
Have just issued new

CATALOGUE

—OF—

LIGHT MACHINERY & SMALL TOOLS.

Sent free to Manufacturers and Dealers on receipt of their business card.



Bradley's Cushioned Hammer

Stands to-day WITHOUT AN EQUAL.

OVER 800 IN USE.

BRADLEY & CO., Syracuse, N. Y.

ESTABLISHED IN 1832.

All descriptions of Gear Wheels or Gear Cutting to order.

Large variety of Ready-made Gears in Stock.

Send for Gear Book, gratis.

GEO. B. GRANT, 66 BEVERLY STREET, BOSTON.

A BARGAIN.

Three locomotive-pattern **new** steel **BOILERS,** 60″ diameter, containing 81 3½″x15′5″ tubes, furnace about 8½′ long x 5′ wide x 6′ high. Will carry 120 pounds steady working pressure.

One PLANER to plane 63″ wide x 72″ high x 23′ long, in first rate order.

For full particulars address,

COOKE & CO.,

DEALERS IN

MACHINERY & SUPPLIES,

22 CORTLANDT ST., NEW YORK.

FOR SALE.

The following second-hand tools all in good order and for immediate delivery.

1—12½ in. Stroke Slotter.
1—10 in. " "
1—30 in. x 30 in. x 8 ft. Planer.
1—54 in. x 54 in x 16 ft. "
1—60 in. x 60 in. x 36 ft. " widens to
3—9 in. Stroke Shaper. 6 ft. 9 in.
1—17 in. Swing Lathe, 8 ft. bed.
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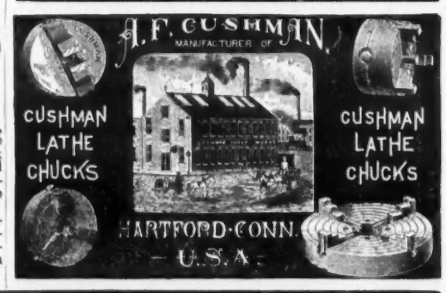

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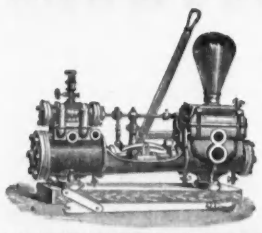

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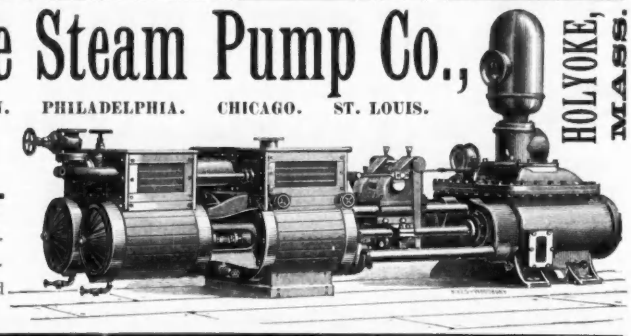

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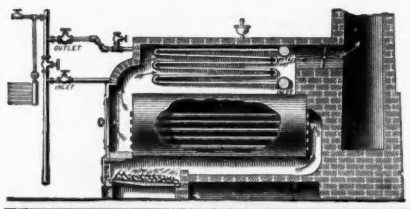

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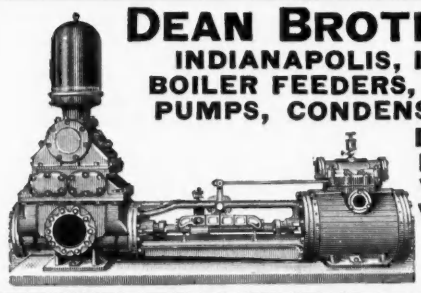

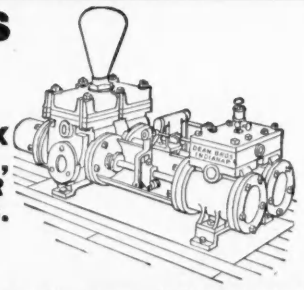

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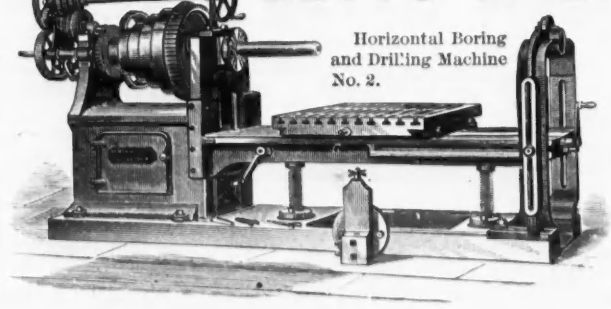

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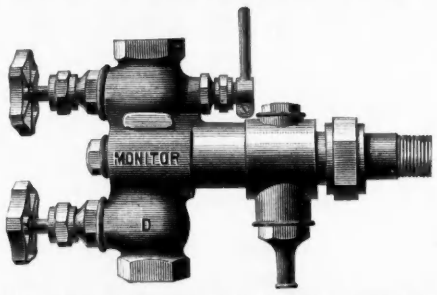

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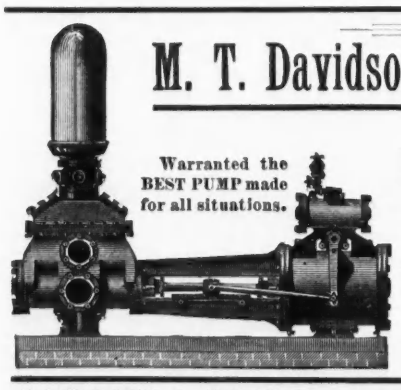

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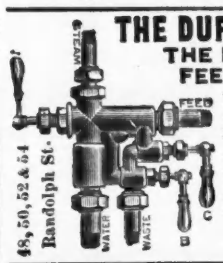

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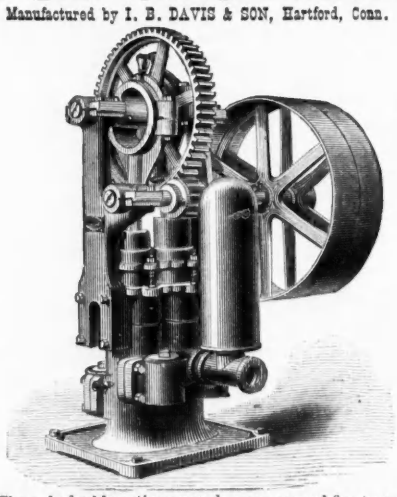

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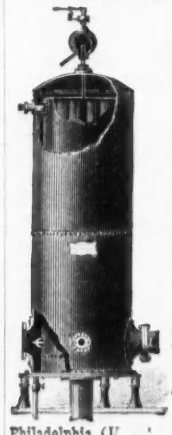

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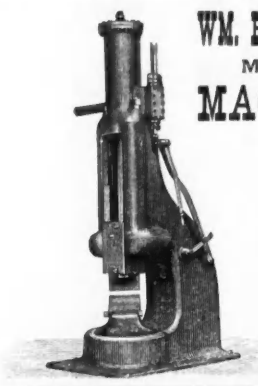

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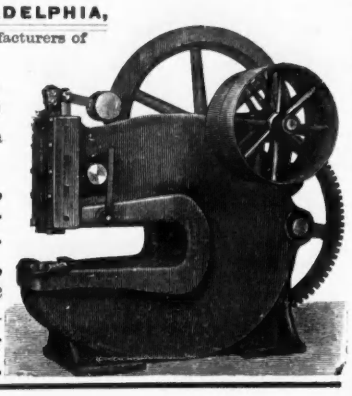

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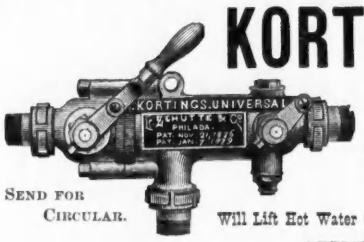

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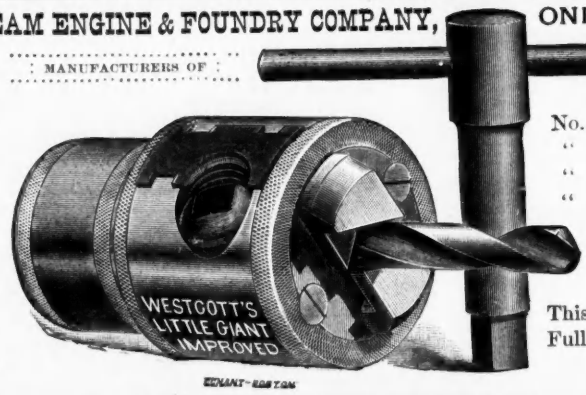

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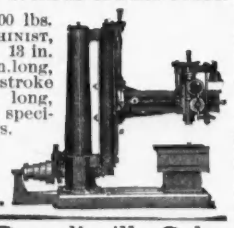

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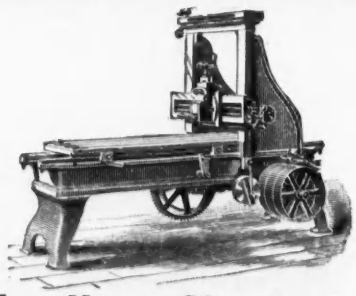

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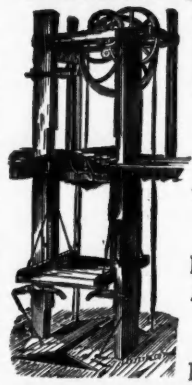

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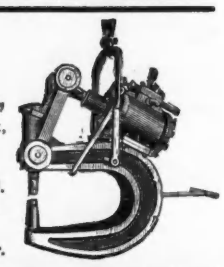

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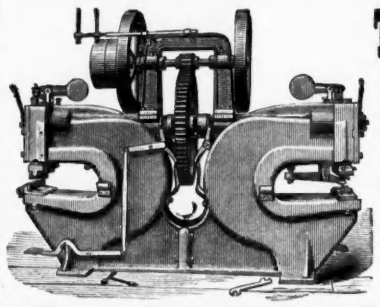

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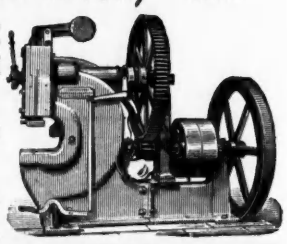

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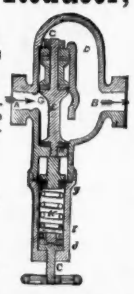

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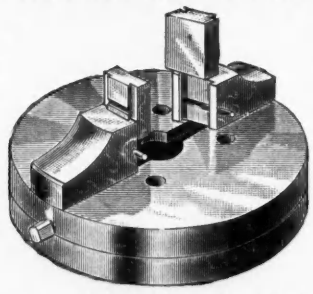

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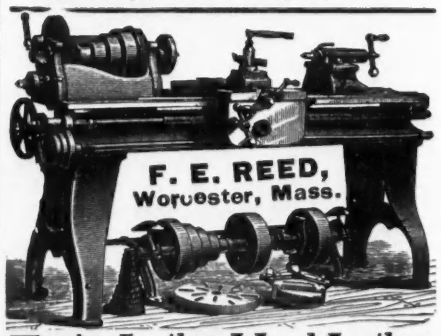

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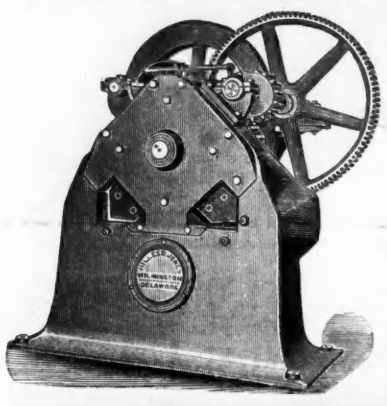

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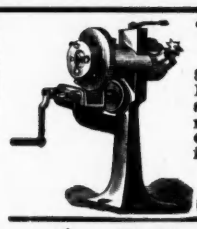

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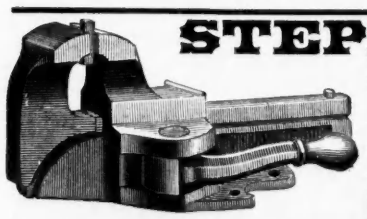

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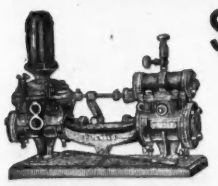

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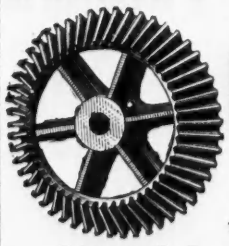

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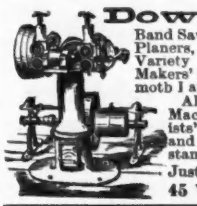

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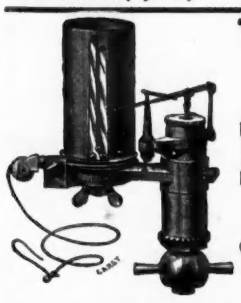

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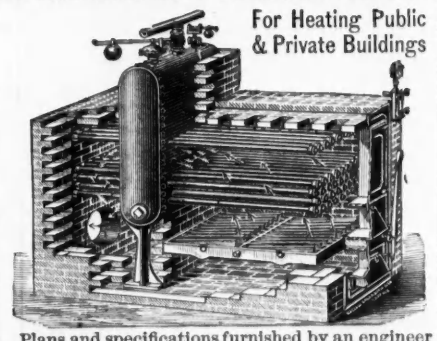

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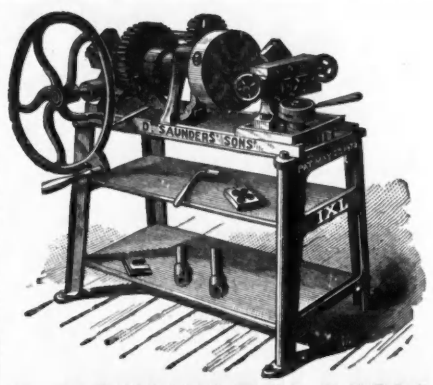

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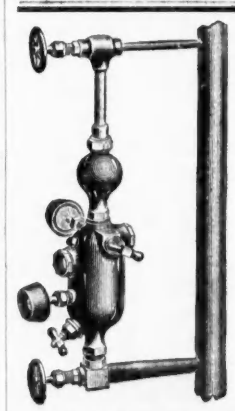

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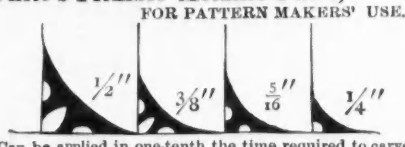

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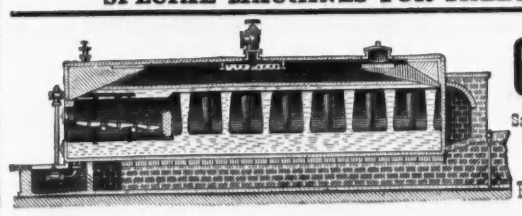

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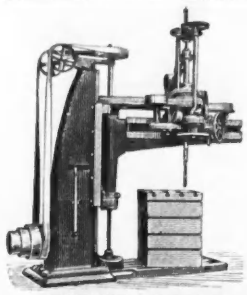

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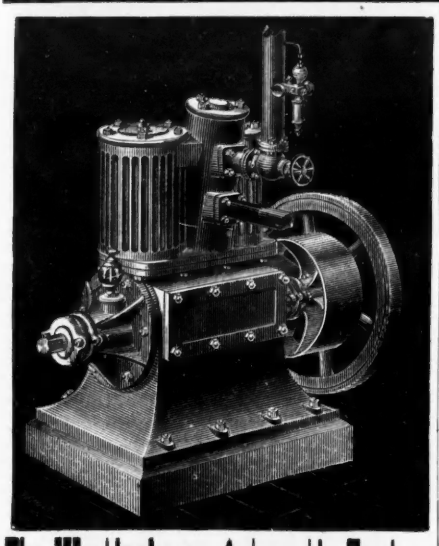

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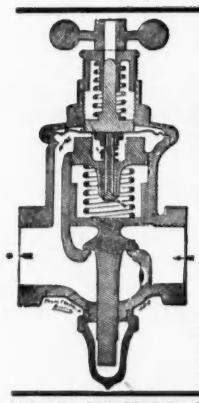

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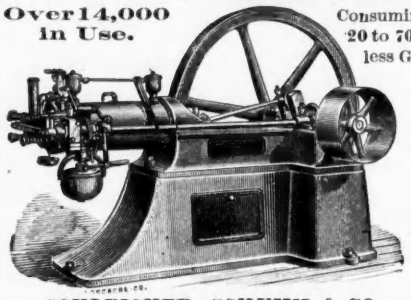

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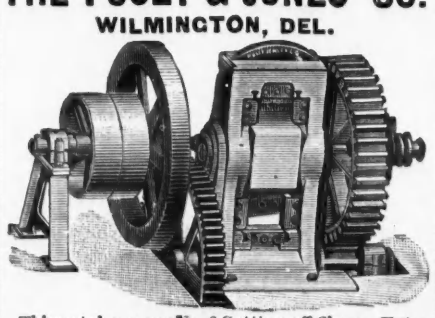

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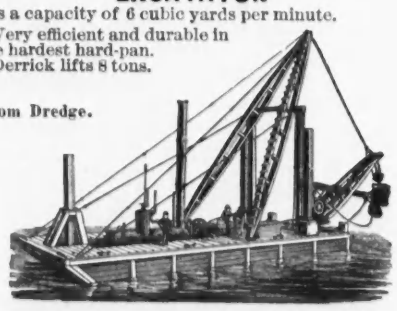

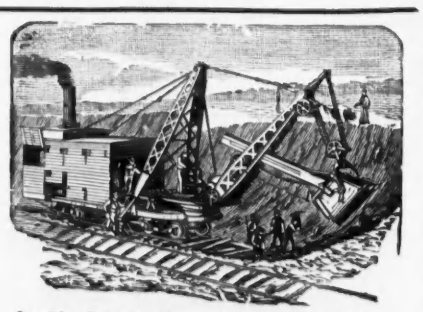

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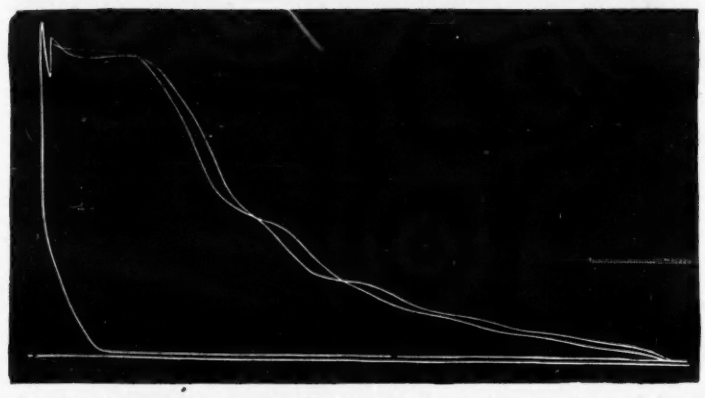

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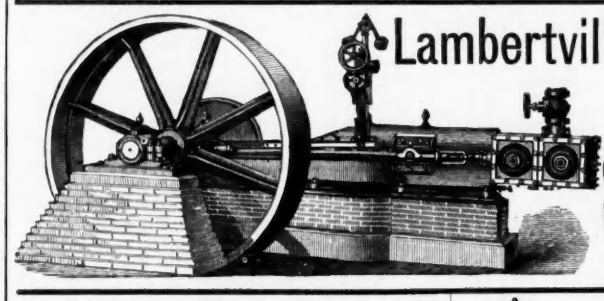

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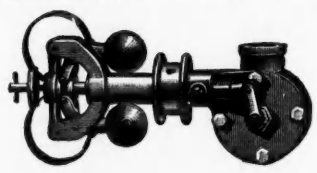

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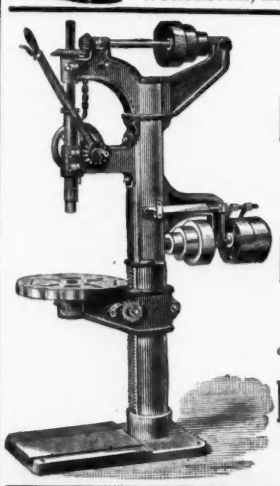

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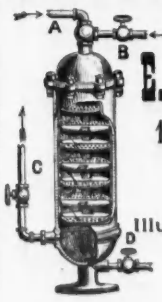

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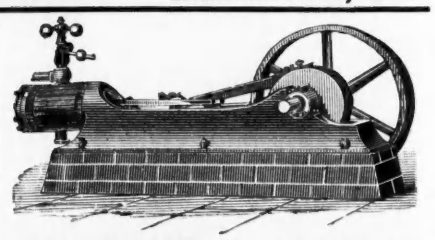

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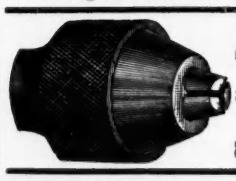

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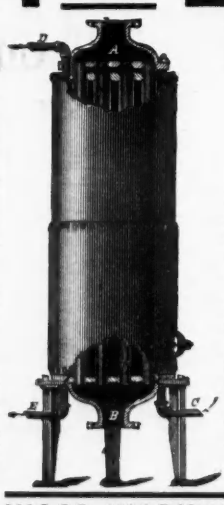

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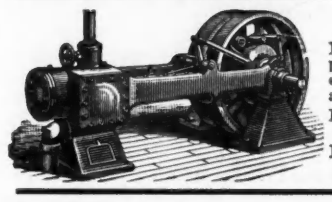

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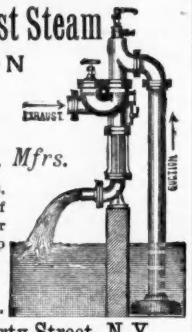

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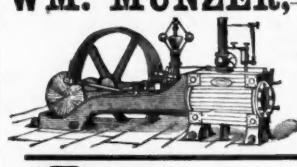

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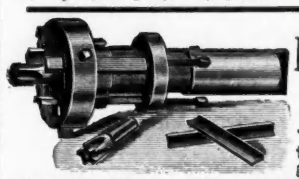

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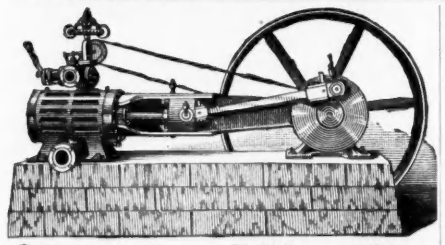

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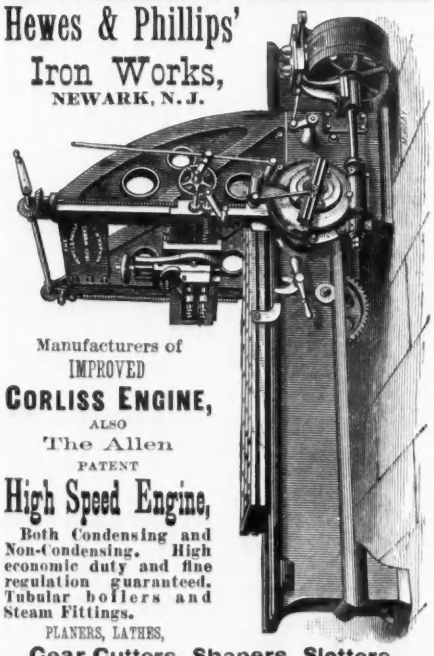

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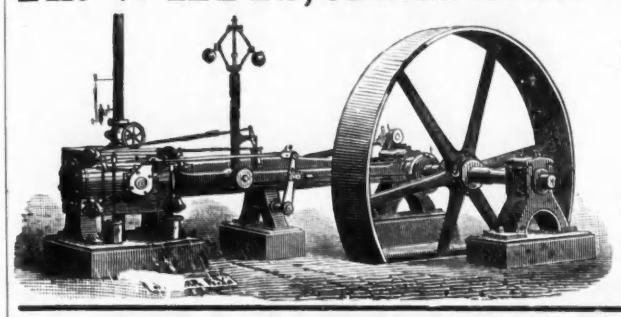

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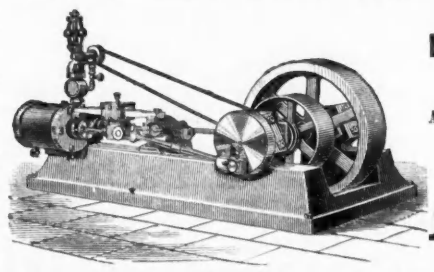

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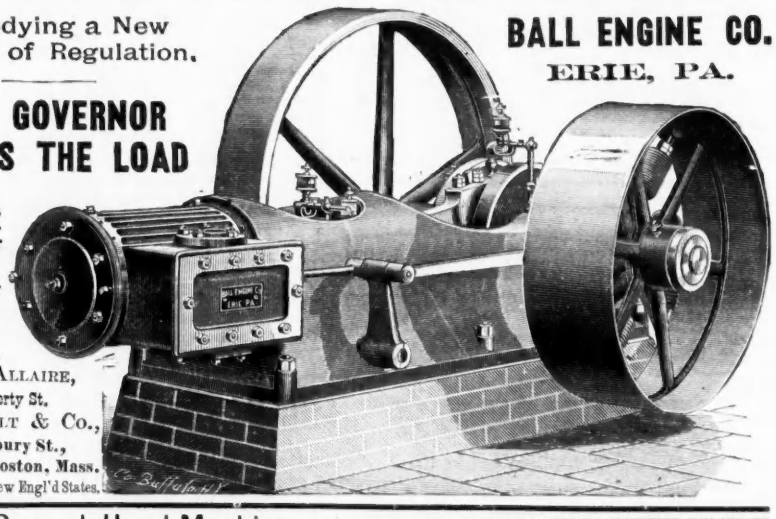

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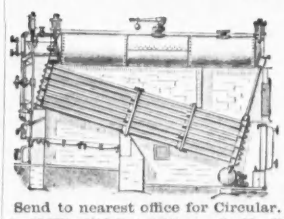

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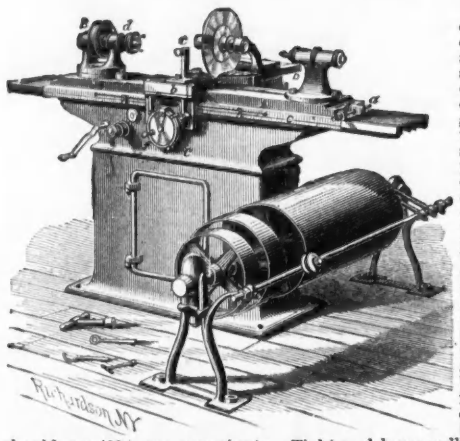

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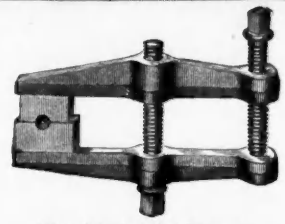

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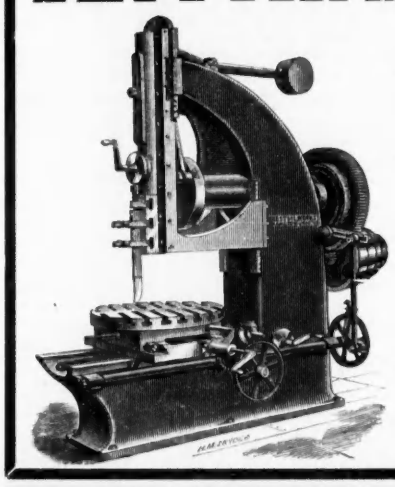

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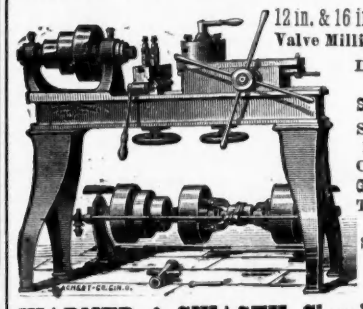

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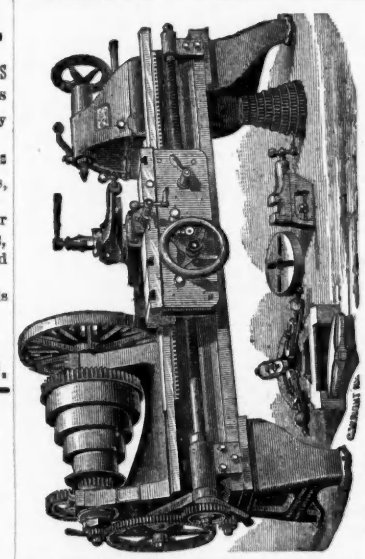

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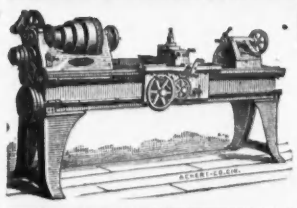

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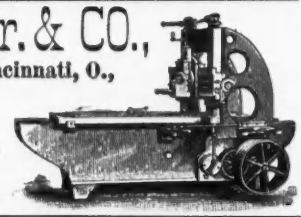

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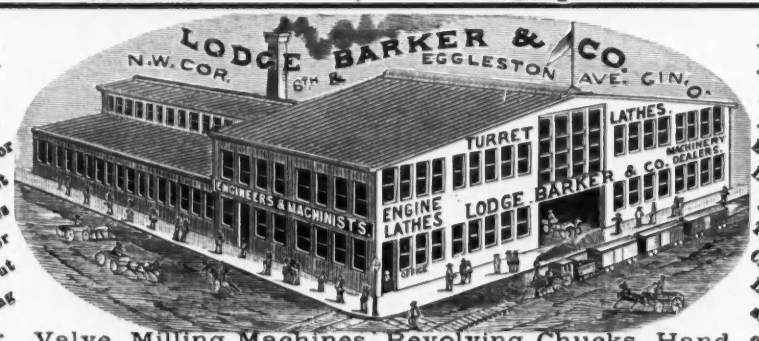

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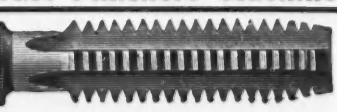

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